Electrical World

FOUNDED IN 1874 • READ BY ELECTRICAL MEN FOR 69 YEARS

May 1, 1943 Vol. 119, No. 18

Contents

What's Different About Cold Cathode? 38
A. C. BARR and C. M. CUTLER, General Electric Company

Blading Repair on a 100,000-Kw. Unit 41
C. T. HOYT, Southern California Edison Company, Ltd.

Disaster Can Build Public Relations 43

Appropriate Regulator Range—Three Ways of Checking 44

Regulators Conserved by Graphic Analyzer 44
E. D. HARTZELL and R. C. THOMPSON, Central Illinois Public Service Company

Regulator Range Checked by Annual One-Day Survey 45
PAUL H. JEYNES, Public Service Electric and Gas Company

Mechanical Operation Analyzer for Induction Regulator 47
ROBERT V. BAKER, Union Electric Company of Missouri

War Stringencies Accelerate Simplified Substation Design 48

Salvage Wire, Hardware, Lamps, Insulators 50

Priorities Problems 52

Editorials ..... 37 and 54

Washington Comment 56

News of the Week 57

How 66

Load Service 98

New Equipment 102

News About People 107

Manufacturing and Markets 116

Recent Rate Changes—Recent Legislation 119

Sales Opportunities 120

Letters to the Editor 123

Index of Advertisements 126

UNIVERSITY OF CALIFORNIA
MAY 14 1943
LIBRARY

★

S. B. WILLIAMS ..... *Editor*

FRANK R. INNES ..... *Managing Editor*
A. E. KNOWLTON ..... *Associate Editor*
LAURENCE WRAY ..... *News Editor*
R. M. SHOOP ..... *Assistant Editor*
E. M. GLENNON ..... *Assistant News Editor*
D. T. BRAYMER ..... *Western Editor*
H. S. KNOWLTON ..... *New England Editor*
GEORGE C. TENNEY ..... *Pacific Coast Editor*
G. E. DOYING, Jr., *Washington Correspondent*

★

W. K. BEARD, Jr. ..... *Publisher*

DISTRICT MANAGERS
E. F. COFFEY ..... New York
N. V. PALMER ..... Boston
W. K. BEARD ..... Philadelphia
F. P. COYLE ..... Philadelphia
C. R. LIPPOLD ..... Cleveland
S. H. BABCOCK ..... Detroit
G. J. SEAMAN ..... Chicago
G. G. SEARS ..... St. Louis

★

ELECTRICAL WORLD

Published weekly. Price 25 cents a copy. Allow at least ten days for change of address. Address communications about subscriptions to Director of Circulation, Electrical World, 330 West 42nd Street, New York, N. Y.

RETURN POSTAGE GUARANTEED

Subscription rates: In the United States, Mexico, Central and South American countries, $5 a year, $8 for two years, $10 for three years, Canada $5.50 for one year, $9 for two years, $11 for three years (Canadian money at par). Great Britain and British possessions, 54 shillings for one year, 108 shillings for three years. All other countries $9 for one year, $18 for three years. Entered as second-class matter November 16, 1936, at Post Office at Albany, N. Y., under the Act of March 3, 1879. Printed in U. S. A.

Contents copyrighted, 1943, by McGraw-Hill Publishing Company, Inc.

Branch Offices: 520 North Michigan Avenue, Chicago; 68 Post Street, San Francisco; Aldwych House, Aldwych, London, W. C. 2; Washington, Philadelphia, Cleveland, Detroit, St. Louis, Boston, Los Angeles, Atlanta, Ga.

★

McGRAW-HILL PUBLISHING CO., INC.
JAMES H. McGRAW
Founder and Honorary Chairman

Publication Office
99-129 North Broadway, Albany, N. Y.
Editorial and Executive Offices
330 West 42nd Street, New York, N. Y.

JAMES H. McGRAW, Jr. ..... President
HOWARD EHRLICH ..... Executive Vice-President
MASON BRITTON ..... Vice-President
B. R. PUTNAM ..... Treasurer
JOSEPH A. GERARDI ..... Secretary
J. E. BLACKBURN, Jr. ..... Director of Circulation

Member A.B.P. Member A.B.C.
Cable Address McGRAWHILL, New York

The contents of this issue are copyrighted and may not be reproduced without the permission of the copyright owner.

CHANGE OF ADDRESS

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd Street, New York, N. Y.
Director of Circulation:

Please change my address on Electrical World

From .....

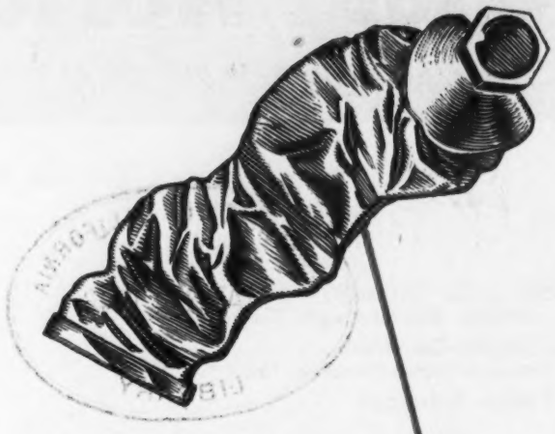
.....

To .....

.....

Signed .....

HOW YESTERDAY'S CABLE RESEARCH HELPS WIN TODAY'S WAR



This advertisement on the Conservation of Tin *could have been written 15 years ago!*

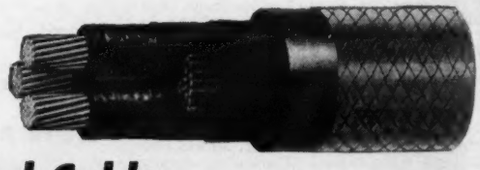
In making rubber-insulated wires, all copper must be coated to prevent chemical reactions between the copper conductor and the rubber insulation. Until 1928, tin was the best known separator.

Then Okonite research men developed a lead alloy to replace the usual pure tin coating for the conductor in rubber-insulated wires and cables. This alloy is known as Okoloy. It outlasts "tinning" at least two to one. Today, the use of Okoloy also results in large savings of vital tin.

Our tin supply is so critical that it is necessary to return an empty tooth-paste or shaving-cream tube when purchasing a new one. The accumulation of even such small tin savings will help build aircraft carriers and other implements of war.

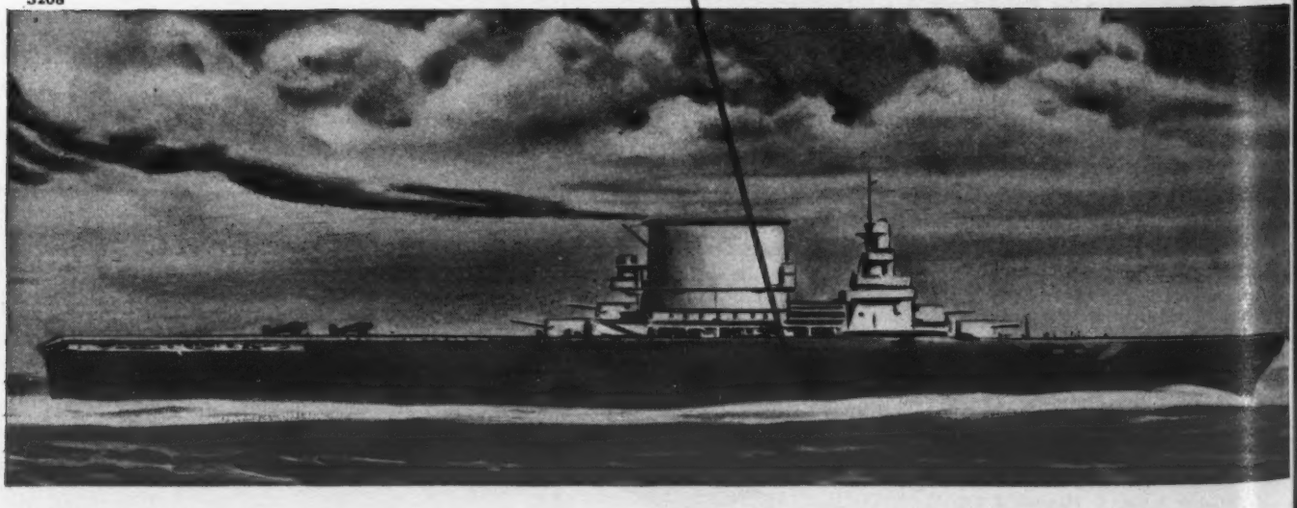
This is but one example of how Okonite's continuous research frequently helps solve national economic problems that were not anticipated when the research work was conducted. And this continuing research is finding new insulations and new cables that are today being devoted solely to the winning of the war but later will be of immense value to American Industry. » » » The Okonite Company, Passaic, N. J. Offices in Principal Cities.

OKONITE



Insulated Wires and Cables

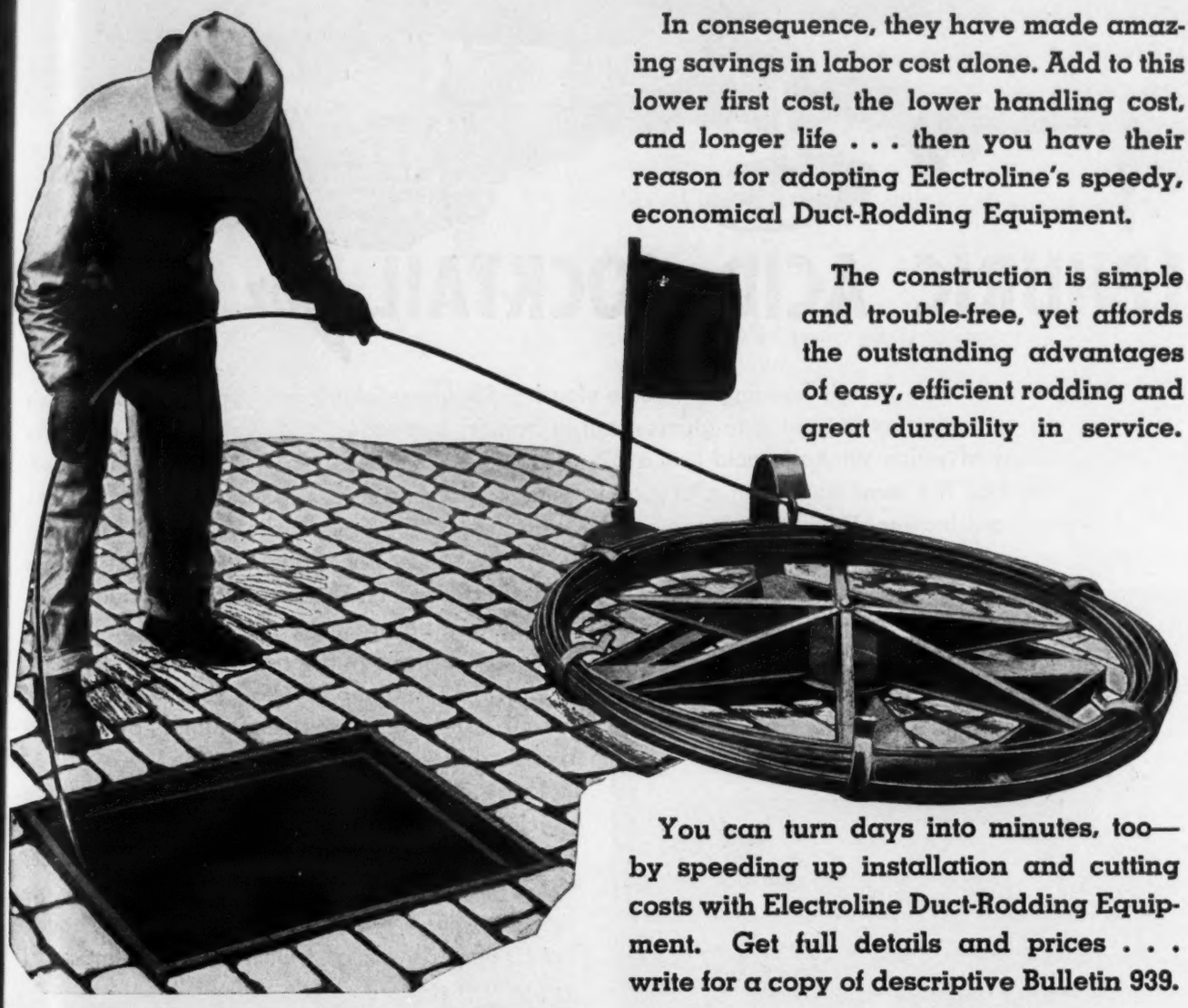
3268



UTILITIES have found that one gang, with Electroline Steel Duct-Rodding Equipment, can make a half-hour job out of one that formerly took two gangs two weeks with old-style equipment!

In consequence, they have made amazing savings in labor cost alone. Add to this lower first cost, the lower handling cost, and longer life . . . then you have their reason for adopting Electroline's speedy, economical Duct-Rodding Equipment.

The construction is simple and trouble-free, yet affords the outstanding advantages of easy, efficient rodding and great durability in service.



You can turn days into minutes, too—by speeding up installation and cutting costs with Electroline Duct-Rodding Equipment. Get full details and prices . . . write for a copy of descriptive Bulletin 939.

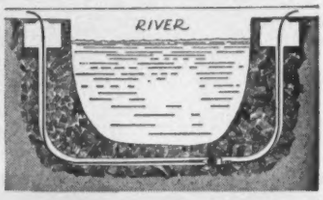
Thirty minutes or two weeks ?

Pick-up and Leader fittings meeting.

Right, Electroline Steel Rodding Equipment feeds easily around the bends.

Below, Leader locked in Pick-up for either push or pull.

PATENT APPLIED FOR



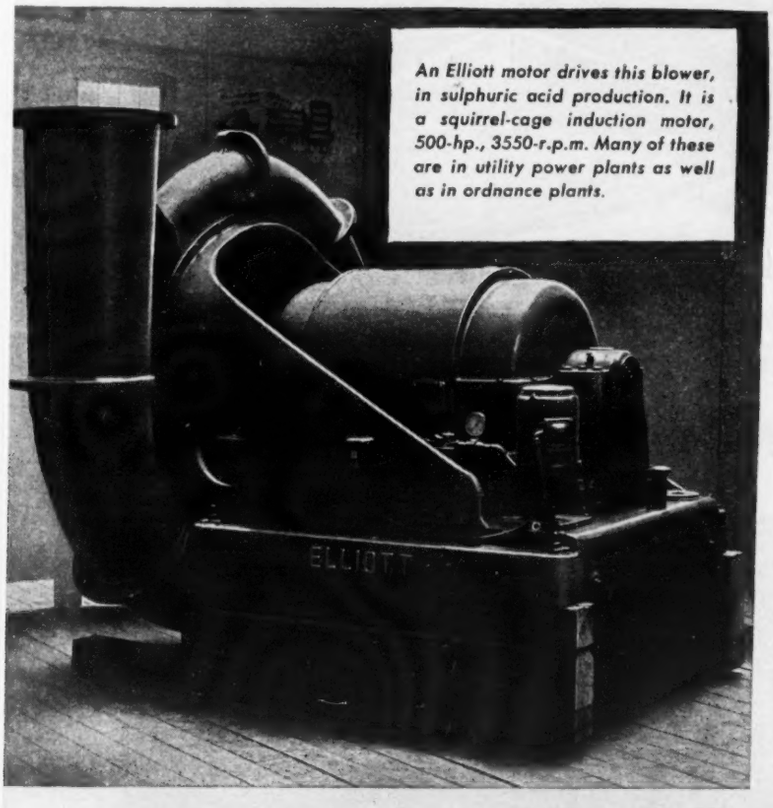
Electroline Company

4121 SOUTH LASALLE STREET
CHICAGO, ILLINOIS

SULPHURIC ACID COCKTAIL *for* ADOLF

Right now Uncle Sam is handing out some nice hot fuming sulphuric acid cocktails to the Axis powers, maybe not in neat little glasses, but in bombs, torpedoes, and shells, in the explosive qualities of which sulphuric acid has a big part. And the dose is rapidly being increased.

Perhaps the most important piece of moving equipment in a sulphuric acid plant is the centrifugal blower. This draws in air for the oxidation of the sulphur dioxide, and forces the gas under pressure through the catalyst holders and gas absorbers. The process is continuous, and the blower never stops for months at a time, humming along day after day at 3600 r.p.m. or higher. Elliott Company has supplied many of these blowers, driven by Elliott motors of the high-speed squirrel-cage, induction type.



An Elliott motor drives this blower, in sulphuric acid production. It is a squirrel-cage induction motor, 500-hp., 3550-r.p.m. Many of these are in utility power plants as well as in ordnance plants.

These Elliott motors are representative of a specialized line developed with great success by Elliott engineers over a 25 year period. Besides being mighty popular in ordnance plants, they are used largely by utilities for high-speed boiler-feed pump drives, as well as in other important applications.

If you need a smooth, dependable, high-speed motor drive, check with Elliott engineers. They can give you that "something extra" in motor design that operating engineers are glad to get. Write. L-742

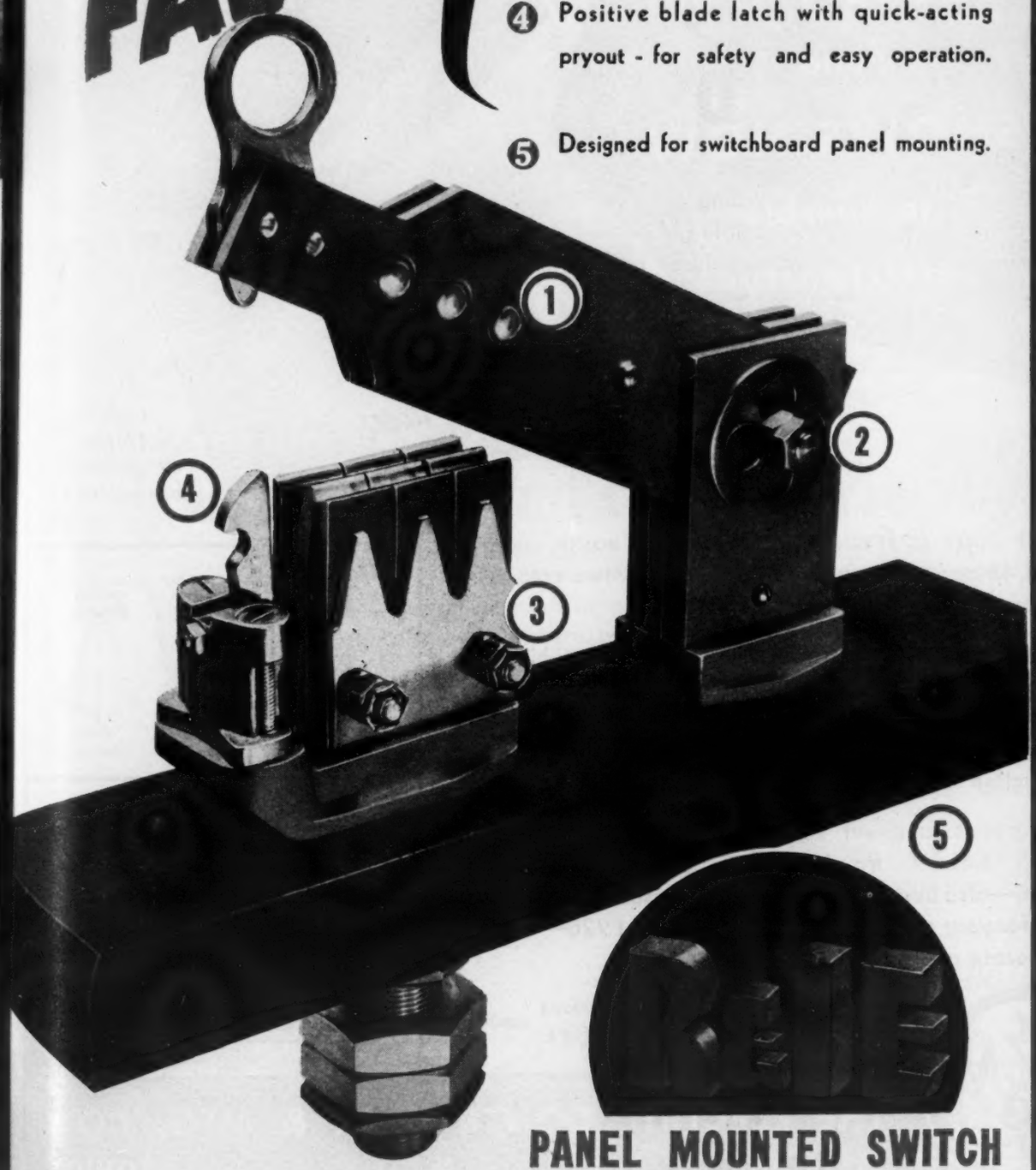
ELLIOTT COMPANY
Electric Power Department
RIDGWAY, PA.
DISTRICT OFFICES IN PRINCIPAL CITIES

ELLIOTT MOTORS

For important drives

CHECK the FACTS

1. Hi-Pressure, self-cleaning Silver Spot Contacts - remove dirt and corrosion.
2. Hi-Pressure, annular, silver line, contact hinge - dirt free. Constant contact in all blade positions.
3. Individual pressure springs insure uniform contact loading at all times.
4. Positive blade latch with quick-acting pryout - for safety and easy operation.
5. Designed for switchboard panel mounting.



PANEL MOUNTED SWITCH

The Black list

CONDUCTOR SUPPORTS CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

AIR BREAK SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

SWITCH OPERATING MECHANISMS

SUBSTATIONS

OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SECTIONALIZING EQUIPMENT

METAL CUBICLES

TESTING DEVICES

RAILWAY AND INDUSTRIAL ENGINEERING CO., GREENSBURG, PA.

IN CANADA—EASTERN POWER DEVICES, LIMITED, TORONTO

HERE'S HELP!

In Training Crane Operators

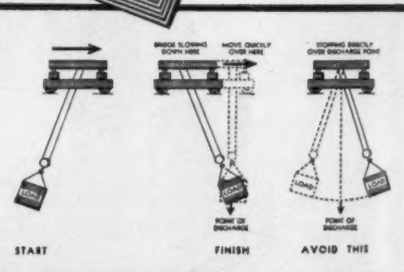
TELLS HOW
and
SHOWS HOW
to operate
efficiently

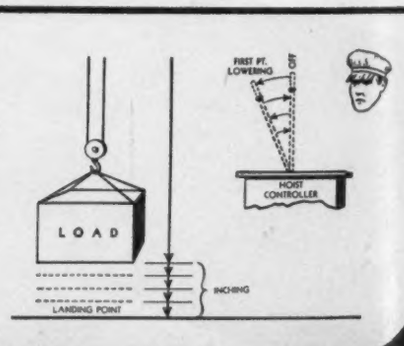
The first Crane MANUAL ON OPERATION ever published

Your copy is free! A simply written, easily understood 48-page Manual. 70 illustrations—two colors—handy, pocket size.

Contents include safety rules—operating hints—inspection-guide for daily report on condition of crane, suggestions on how to avoid trouble, etc. Explains and pictures what *not* to do as well as how to get *more* production safely.

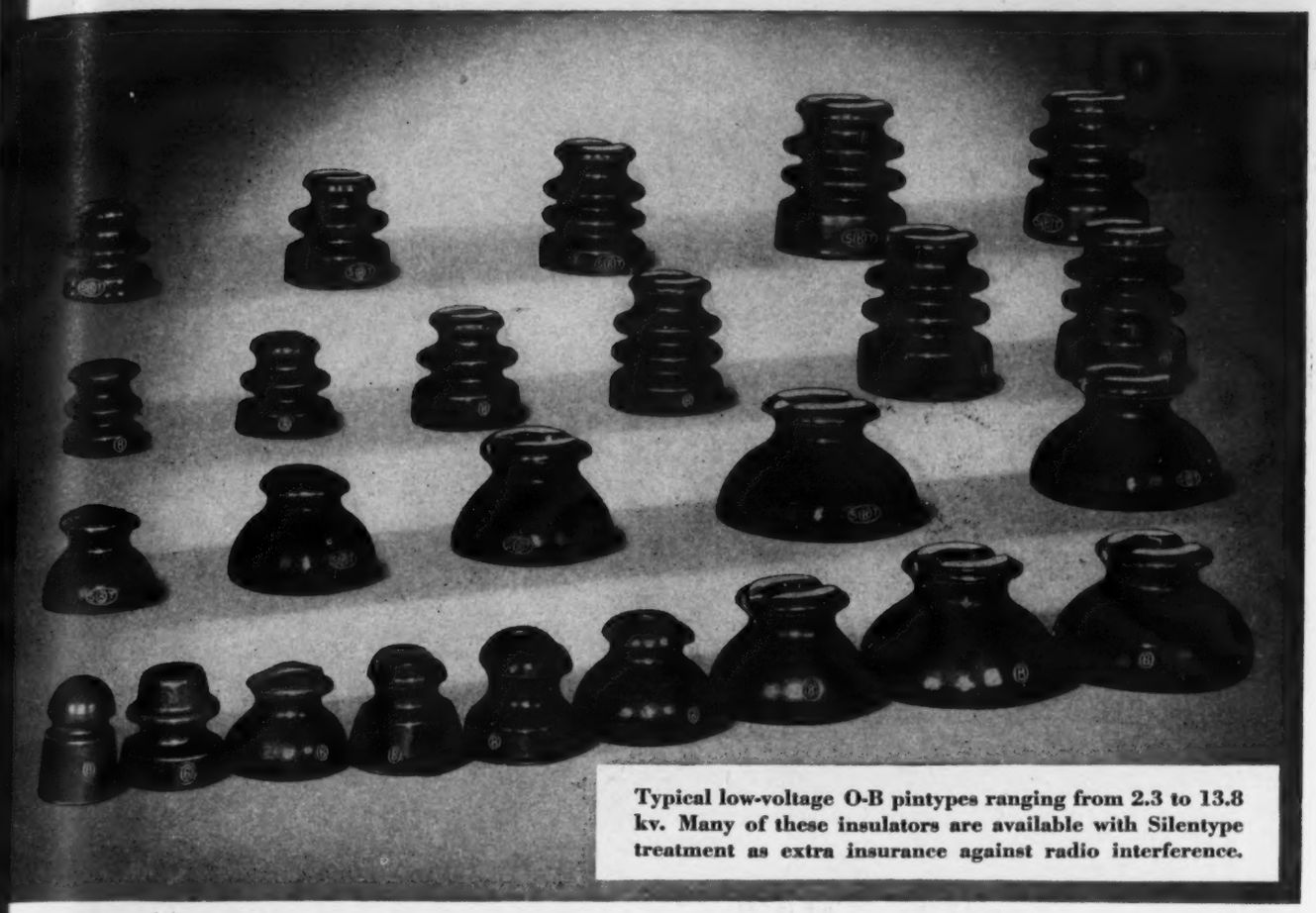
Applies to direct current overhead cranes—*all makes*. Useful in training new operators—including women—also beneficial for the more seasoned operator. Send for your copy to-day. Ask for Booklet 920—"How to Operate a Crane."





Typical illustrations from the MANUAL

THE ELECTRIC CONTROLLER & MFG. CO.
CLEVELAND ★ OHIO



Typical low-voltage O-B pintypes ranging from 2.3 to 13.8 kv. Many of these insulators are available with Silentype treatment as extra insurance against radio interference.

An Easy Way To Be Sure You're *Right!*

Here's how to put the same high quality porcelain insulation on your low-voltage distribution lines as you have on your transmission system, and with the same results--long, trouble-free life. O-B low-voltage pintypes differ only in shape from the largest insulator we make...On your next low-voltage insulation requirements, check into this important question: are these insulators made by skilled workmen under fine manufacturing conditions, and is *wet ware* porcelain used--the kind that goes into the high-voltage field?... There's a very easy way of answering this question. Just buy O-B. Information and service readily available from your nearby Graybar office and warehouse.

2438-H

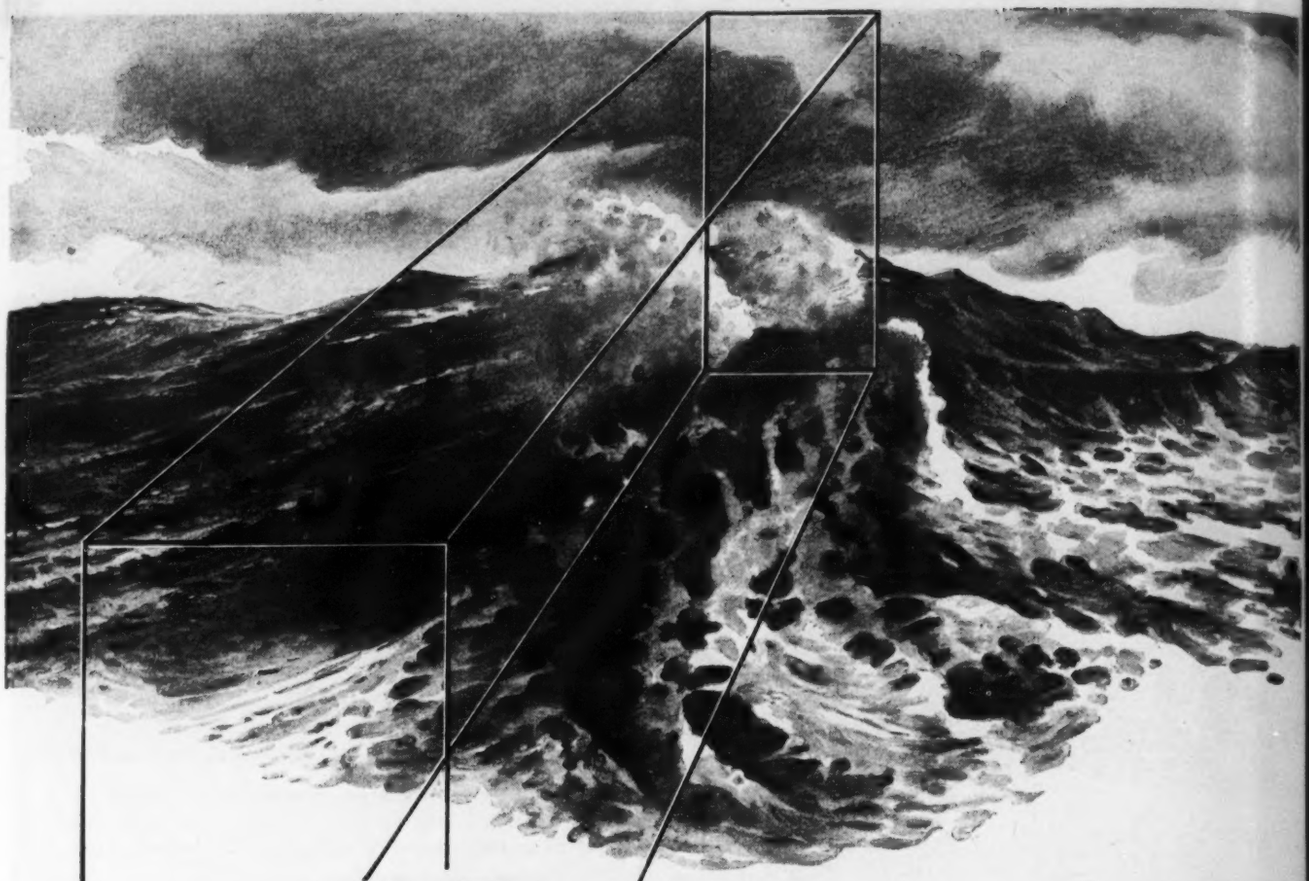
Ohio Brass

MANSFIELD, OHIO, U. S. A.

Canadian Ohio Brass Company, Ltd., Niagara Falls, Ont.

GraybaR QUALITY SINCE 1869 — *Distributed by* GraybaR ELECTRIC COMPANY

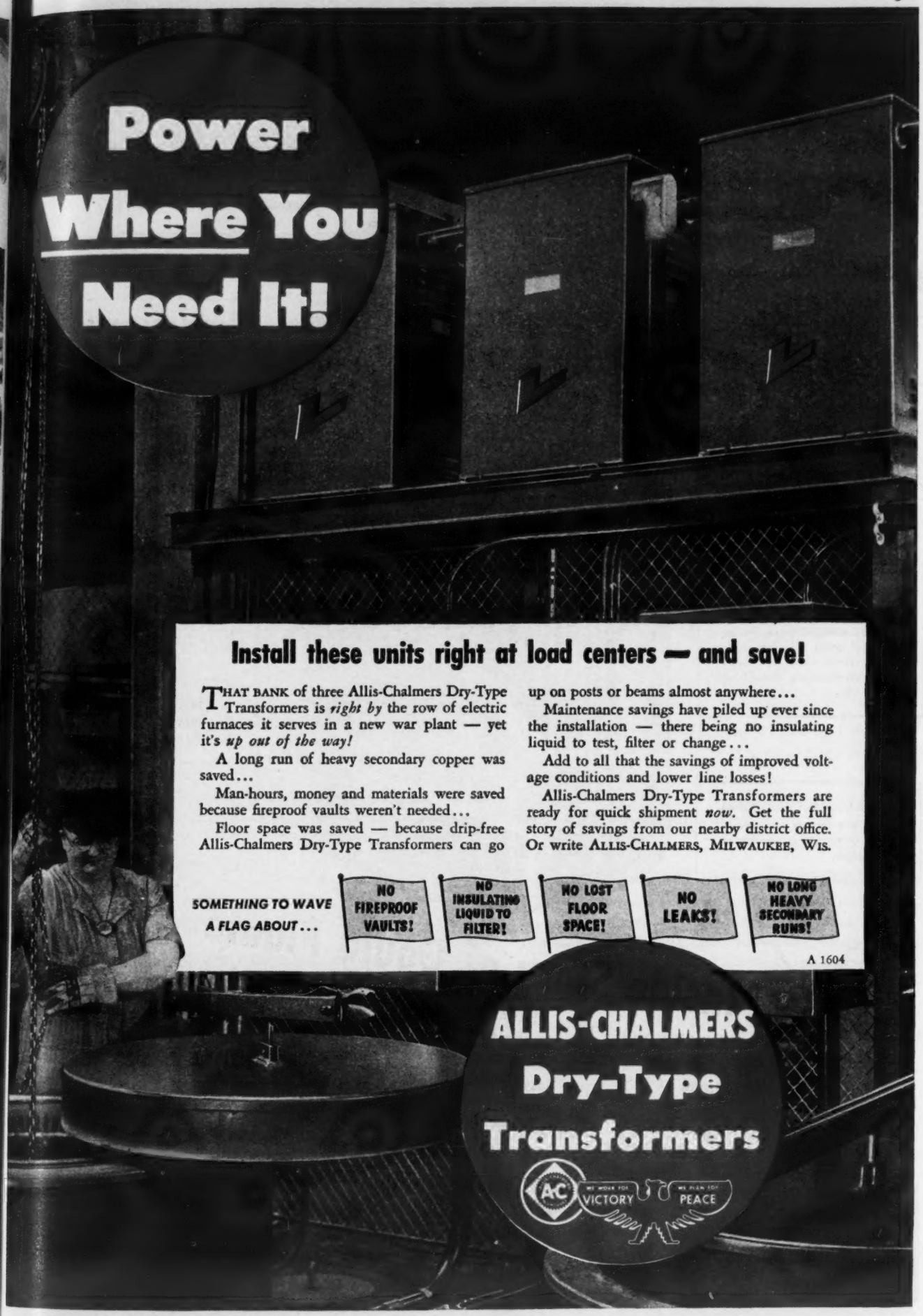
★ KEEP BUYING WAR BONDS ★



THE BRICK THAT SAVED A THOUSAND SHIPS

Dehydrated food saves shipping space.
Compressed dehydrated food briquettes
Save still more space.
Thus, one supply ship can now carry
The food equivalent of ten supply ships . . .
And each ship can provision ten times
As many soldiers as ever before.
Air conditioning and refrigeration equipment
Makes possible these dehydrated food bricks . . .
Dependable and efficient cooling equipment
Provided by General Electric. After the war,
When air conditioning and refrigeration
Will again become available to the public,
Take advantage of G-E experience
In the fields of air conditioning and
Commercial and industrial refrigeration . . .
Turn to General Electric.
Air Conditioning and Commercial Refrigeration Department, Division 435, General Electric Co., Bloomfield, N. J.

Air Conditioning by **GENERAL ELECTRIC**



Install these units right at load centers — and save!

THAT BANK of three Allis-Chalmers Dry-Type Transformers is *right by* the row of electric furnaces it serves in a new war plant — yet it's *up out of the way!*

A long run of heavy secondary copper was saved...

Man-hours, money and materials were saved because fireproof vaults weren't needed...

Floor space was saved — because drip-free Allis-Chalmers Dry-Type Transformers can go up on posts or beams almost anywhere...

Maintenance savings have piled up ever since the installation — there being no insulating liquid to test, filter or change...

Add to all that the savings of improved voltage conditions and lower line losses!

Allis-Chalmers Dry-Type Transformers are ready for quick shipment *now.* Get the full story of savings from our nearby district office. Or write ALLIS-CHALMERS, MILWAUKEE, WIS.

SOMETHING TO WAVE A FLAG ABOUT...

NO FIREPROOF VAULTS! | NO INSULATING LIQUID TO FILTER! | NO LOST FLOOR SPACE! | NO LEAKS! | NO LONG HEAVY SECONDARY RUNS!

A 1604

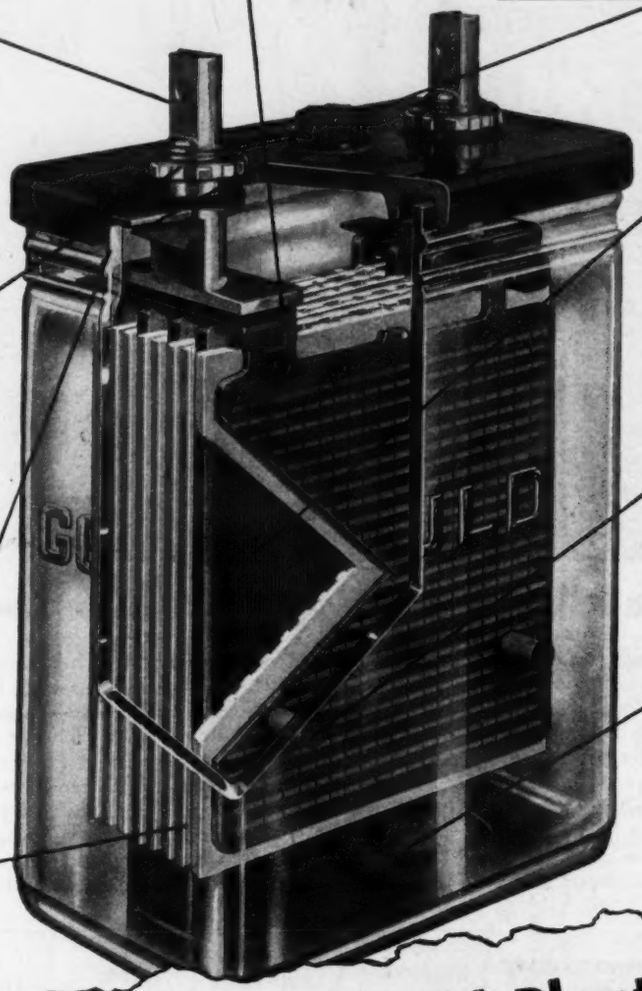
ALLIS-CHALMERS
Dry-Type Transformers

AC — WE WORK FOR VICTORY — WE PLAN FOR PEACE

GOULD DUAL SUSPENSION (patented) eliminates all possibility of mechanical failure. Positive and negative groups are supported by channels held by the crossbar and plate assembly; these in turn are supported by the terminal post projections resting on top edge of wall.

LARGE VENT PLUGS and vent openings save time in battery maintenance.

TERMINAL POSTS of exceptionally large cross section area are an assurance against mechanical failure and provide ample current carrying capacity.



ONE PIECE PURE LEAD POSITIVE, with vertical ribs spun by exclusive Gould process, gives extra large surface area for electrolytic action. This one piece construction eliminates possibility of plate fracture and assures high-sustained capacity for many years of service.

SEAL NUTS of annular antimony-lead draw the post flanges tightly against gaskets and the underside of cover to form a perfect seal.

BUFFERS inserted in the outside negative plates hold all plates and separators in place.

NO STRAIN ON COVER—top edges of jar walls act as support for plates. Projections cast as integral parts on all terminal posts transfer strain from cover to walls. No broken or distorted covers throughout life of cell.

SEDIMENT SPACE of ample capacity assures full service life without cleaning.

SEPARATORS of treated white cedar are deeply grooved to allow adequate circulation of electrolyte.

Inside Story of Gould Planté

What comes out of a battery depends on what goes in. Here you can see why Goulds do the job better, why they're guaranteed to equal or exceed in capacity any battery of comparable size and cell structure and finally, why Gould Plante is your best choice for emergency lighting and control operations . . . Free help on battery problems—write Gould Storage Battery Corporation, Depew, N. Y.

GOULD THE BATTERY PICKED BY ENGINEERS

d-c power problems?

SERVING WAR INDUSTRY

Today, the Ignitron Rectifier is widely accepted as the answer to many power conversion problems. More than 2,000,000 installed capacity is now serving vital war industries.

ignitron

Wherever you need efficient, dependable power conversion in the 250-volt and higher range—that's a job for the Ignitron Rectifier.

Ignitron operating costs are low. Simplified automatic operation, low arc drop loss, the elimination of high starting demand and absence of major moving parts hold both operating and maintenance costs at a minimum.

Installation is easy, too. No special foundations are required. An Ignitron can be installed on any level floor of reasonable strength.

And most important of all is the uniformly high efficiency of Ignitron power conversion. It can handle constant 24-hour loads, peak loads, or light loads, all with the same relatively high efficiency.

It will pay you to investigate the advantages of Ignitron for your particular d-c power requirements. Your nearest Westinghouse office can give you full information. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

for war industries using d-c power

Ignitron power conversion can eliminate many production "headaches" for war plants. May be completely automatic, and operate unattended. And because there are no major moving parts to wear and replace, inspection, repair and maintenance are cut to a minimum. Valuable production hours are saved. Ignitrons are always on the job—delivering service 24 hours a day.

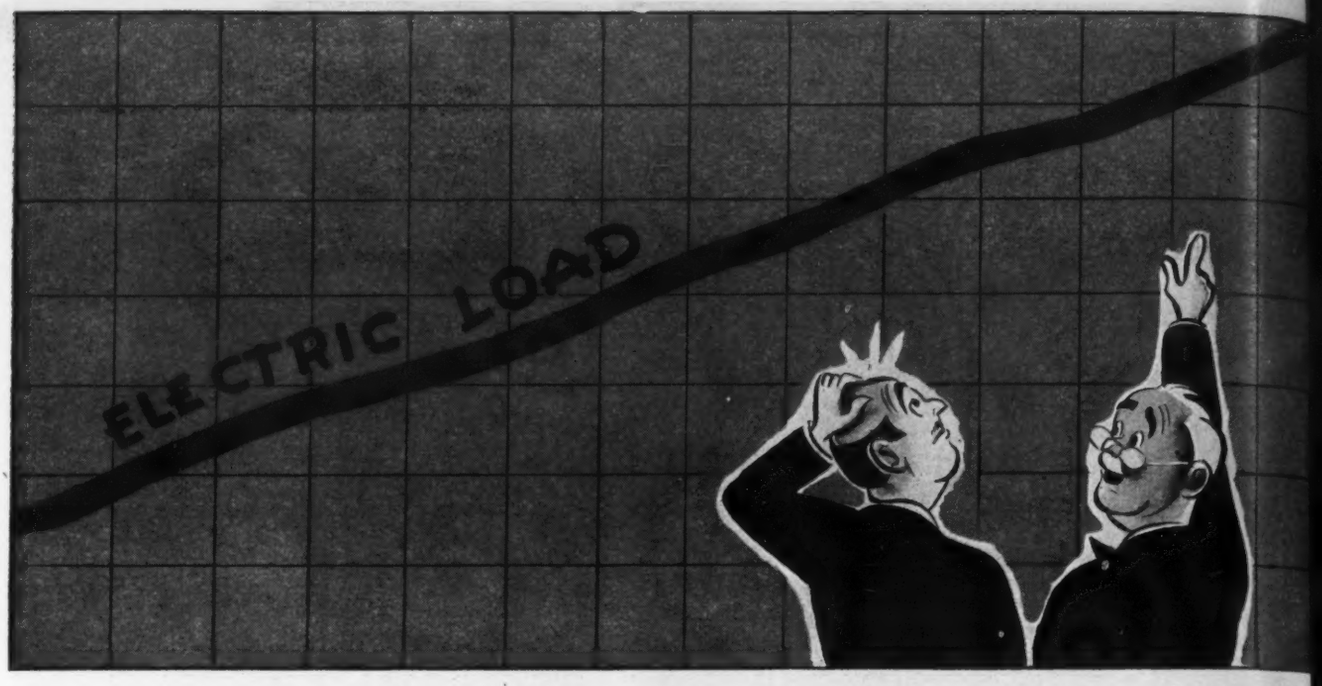
For more complete information about Ignitron power conversion, write Dept. 7-N today for a copy of Book B-3024.

J-10244-4

Westinghouse *Electronics at Work*

IGNITRON RECTIFIERS

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE



Can It Be Kept Up After the War?

We're betting good money that it can

Mighty busy today. Facilities taxed to capacity. But we must all consider what will happen when the need for peak war production ends. How will you stand in the sudden shift to peacetime loads? The answer, to a very large extent, is to increase the use of current by *commercial customers.*

You will find it well worth while to team up with Hotpoint-Edison's forward looking campaign. Our advertising to hotels, restaurants, bakeries, hospitals and institutions is preparing them for the time when they can buy Hotpoint-Edison Commercial Electric Cooking Equipment—the very time when this added load will be most welcome to *you*. You know from experience how much commercial load your system can absorb in off-peak periods.

Thousands of chefs, cooks and bakers now in the armed forces are learning the dependability, safety, simplicity and cleanliness of Hotpoint-Edison electric cooking. When they return to their jobs in hotels, restaurants, bakeries and institutions, their enthusiasm for electric cooking will make the demand greater than ever.

Yes, you certainly can keep that power load up, if you join with us *now* in planning ahead. Your post war revenue from commercial customers can be greatly increased by starting now to push the idea of commercial electric cooking and baking at every opportunity . . . in your advertising, promotion material and contacts. Edison General Electric Appliance Co., Inc., 5618 W. Taylor St., Chicago.

For outstanding achievement in War Production

FOUND ONLY IN MODERN KITCHENS

Hotpoint Edison

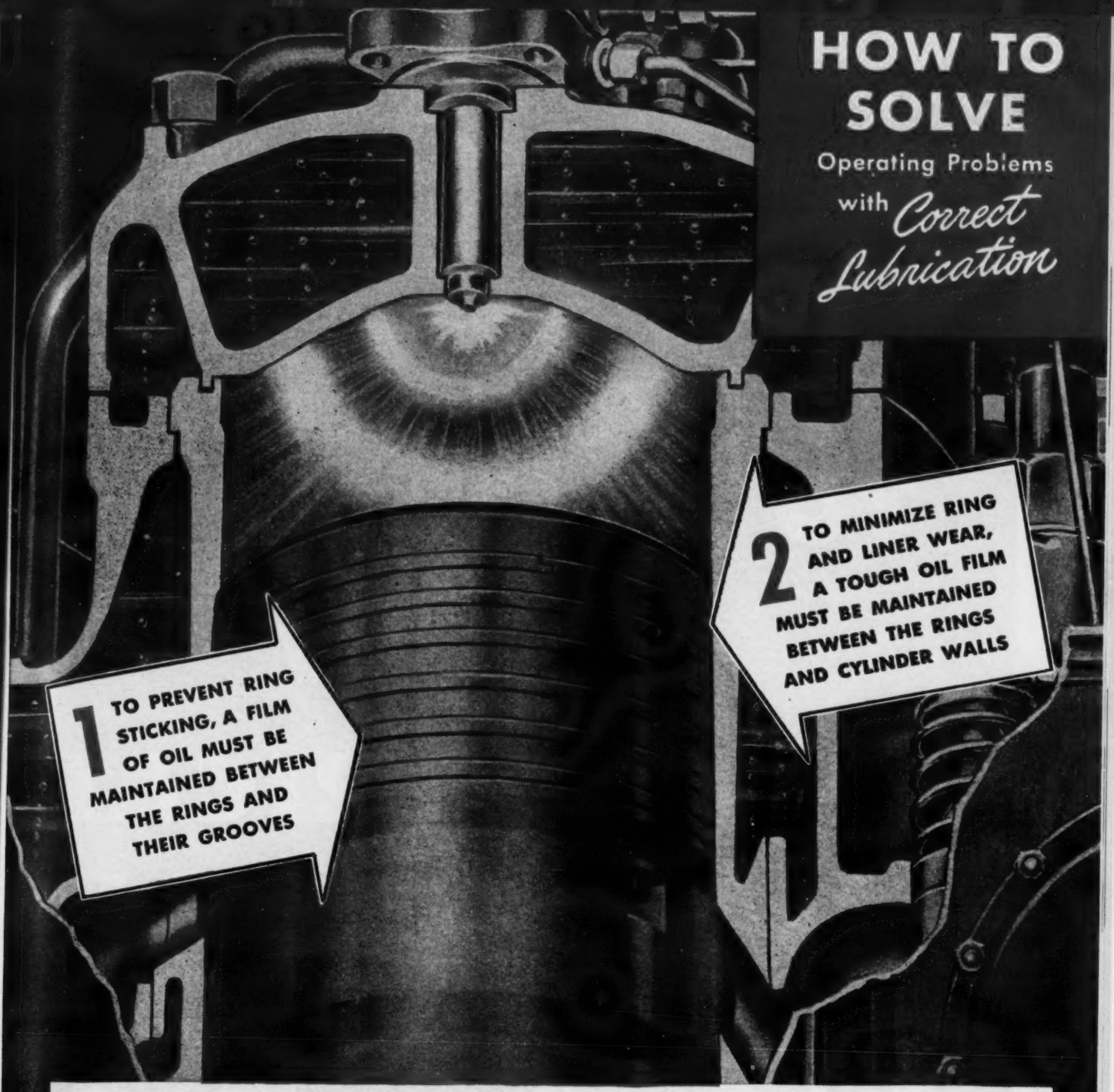
COMMERCIAL ELECTRIC COOKING EQUIPMENT

BOSTON NEW YORK CITY ATLANTA CLEVELAND CHICAGO KANSAS CITY DALLAS LOS ANGELES SEATTLE SALT LAKE CITY

CANADA—Canadian General Electric Company, Ltd., Toronto

OLDEST AND LARGEST MAKER OF ELECTRIC COOKING EQUIPMENT

FOR VICTORY — BUY U. S. WAR BONDS AND STAMPS


HOW TO SOLVE
Operating Problems with Correct Lubrication
1 TO PREVENT RING STICKING, A FILM OF OIL MUST BE MAINTAINED BETWEEN THE RINGS AND THEIR GROOVES
2 TO MINIMIZE RING AND LINER WEAR, A TOUGH OIL FILM MUST BE MAINTAINED BETWEEN THE RINGS AND CYLINDER WALLS

Get 2 Jobs Well Done

AS YOU SEE ABOVE, an oil film must be maintained in a Diesel (1) between the rings and their grooves, and (2) between the face of the rings and the cylinder wall. At these places the oil film is subjected to heat, pressure and oxygen. Inferior oil will oxidize, cook and form hard carbon deposits.

These deposits will cause ring sticking that results in costly wear, power-wasting "blow-by"!

Gargoyle D.T.E. Oil Nos. 1-to-5 give maximum protection against deposits—both on pistons and rings. They have been specifically designed to meet the *severest* requirements of the intermediate and large size engines built and operated today.

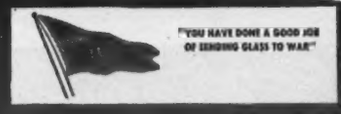
GARGOYLE Lubricants

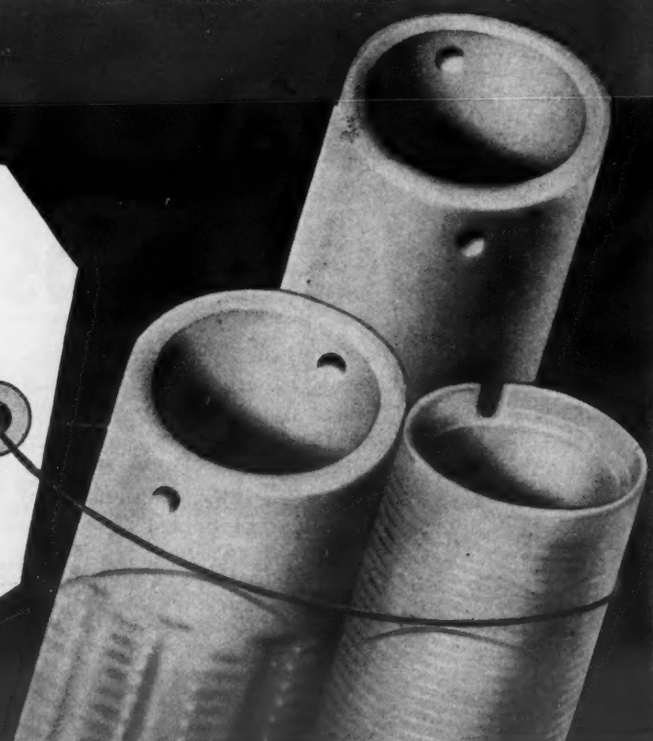
SOCONY-VACUUM OIL COMPANY, INC. — Standard Oil of N. Y. Div. • White Star Div. • Lubrite Div. • Chicago Div. White Eagle Div. • Wadhams Div. • Southeastern Div. (Baltimore) • Magnolia Petroleum Co. • General Petroleum Corp.

CALL IN SOCONY-VACUUM

HOW TO SAVE UP TO 47% ON ELECTRICAL COIL FORMS!

NEW CORNING MULTIFORM GLASS INSULATORS





HERE'S ALL YOU DO TO MAKE ROCK BOTTOM SAVINGS

READ THIS QUICK CHECK LIST THEN MAIL COUPON FOR COMPLETE STORY!

YOU ENJOY LOWEST PRICES WHEN YOUR COIL FORMS COME WITHIN THESE STANDARDS

*1. **OUTSIDE DIAMETERS** between 1 inch and 3 inches.

*2. **WALL THICKNESSES** between 5/32 inch and 9/32 inch.

*3. **LENGTHS** up to 9 inches (with better prices for shorter lengths).

4. **MAXIMUM** of 20 holes for coil forms ¼ inch and 9/32 inch thick with maximum of 4 holes tapped.

5. **MAXIMUM** of 10 holes for coil forms 5/32 inch to 7/32 inch thick with maximum of 2 holes tapped.

6. **MAXIMUM** of 14 grooves to the inch.

*7. **TOLERANCES** on general dimensions ± 2.0%, but not less than ± 0.010 inches.

**Proposed A.S.A. Standards.*

In addition to low-cost standard types, Corning Multiform Insulators may be had in almost any other size or shape.

CLIP THIS COUPON TO YOUR BLUE PRINT- MAIL TODAY FOR ACCURATE QUOTATION!

Pyrex Insulators

BRAND

Corning Glass Works
Insulation Division, Dept. W51, Corning, N. Y.

Please send us estimate on coil forms as per attached blueprint and data below:

Quantity.....

When Needed (date).....

Electrical Characteristics.....

.....

Acceptable Revisions.....

.....

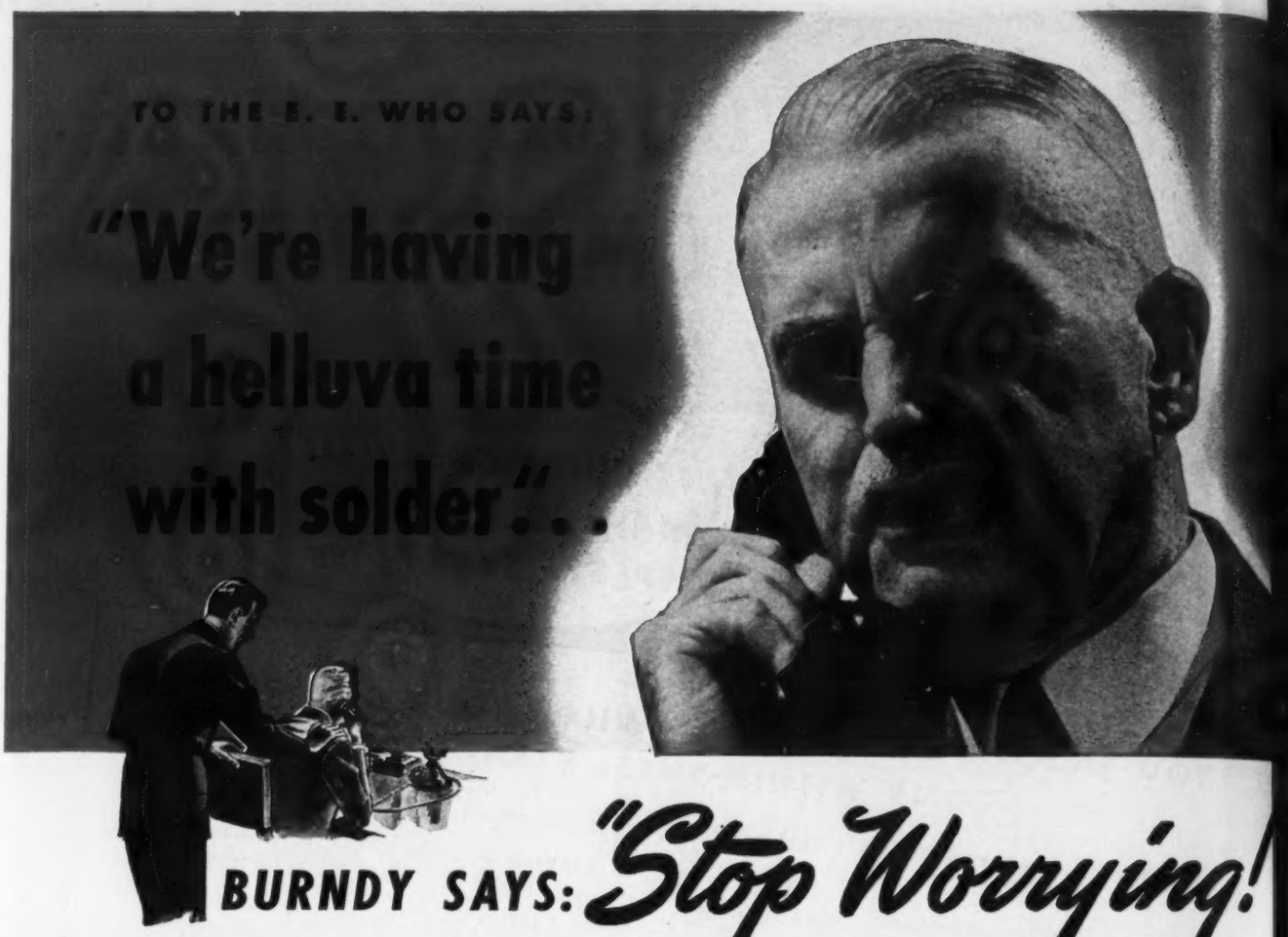
Name.....

Company.....

Street.....

City.....State.....

"PYREX" is a registered trade-mark and indicates manufacture by Corning Glass Works.



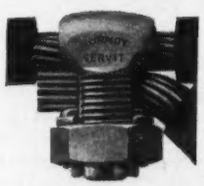
BURNDY SAYS: "Stop Worrying!

YOU DON'T NEED A DROP OF SOLDER TO MAKE A GOOD JOINT!"

3 from thousands

of Burndy Solderless Connectors

Hylug — Type YAG (indent type)



Qiklug — Type QA-B

Servit — Type KS

Burndy left the solder pot behind over 20 years ago—and the millions of sound Burndy *solderless* connectors since put in service under every conceivable operating condition prove what a great step forward this was!

For tiny wire connections, or for the largest conductor connections for heavy current loads, Burndy *solderless* connectors replace the messy, time-wasting solder pot with simple clamping elements . . . providing SPEED and EASE and a BETTER ELECTRICAL CONNECTION.

Whatever connector problem may be bothering you today, Burndy has either solved it in 20 years of specialized engineering in this field — or will solve it for you now, with a connector custom-made to fit your needs. Call in a Burndy representative. If he can't show you time and cost savings decidedly worth-while, invite him to go fly a kite!

Headquarters for connectors

Burndy

The Answer TO YOUR ELECTRICAL CONNECTION PROBLEM

OVERHEAD • UNDERGROUND • POWER • WIRING • GROUNDING

BURNDY ENGINEERING CO., INC. · 107 EASTERN BOULEVARD, NEW YORK CITY

PLAN YOUR DISTRIBUTION SYSTEM

FOR *Maximum Flexibility*

Can you foretell what production demands will be placed on your plant a year or two from today? Emergency additions may be required. Quick conversion to new war products or to peacetime processes may be necessary.

The speed and economy with which these demands can be met depend to a large extent on your plant distribution system. Choosing a system *now* that provides maximum flexibility offers two important advantages:

1. Increased protection against sabotage today.
2. Faster and more economical conversion when necessity requires it.

By bringing broad engineering experience to bear on your particular problem, Westinghouse can help you select the "one best" distribution system for your present plant. It should provide maximum flexibility with the least use of critical materials.

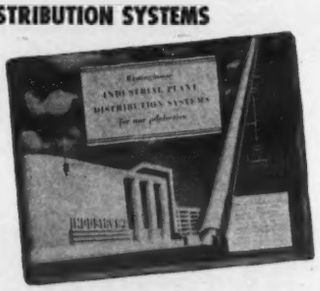
All systems recommended by Westinghouse are designed to use standard distribution equipment. No time is lost in building special apparatus.

For prompt action, call our local office. Or send for the helpful booklet below. Westinghouse Electric & Manufacturing Co., East Pittsburgh, Pa.

J-94561

UP-TO-DATE FACTS ABOUT DISTRIBUTION SYSTEMS

Keep up to date on latest plant distribution systems. Send for 24-page Booklet, B-3152, which briefly describes plant distribution systems, and points out the advantages of each.



Westinghouse

PLANTS IN 25 CITIES . . . OFFICES EVERYWHERE

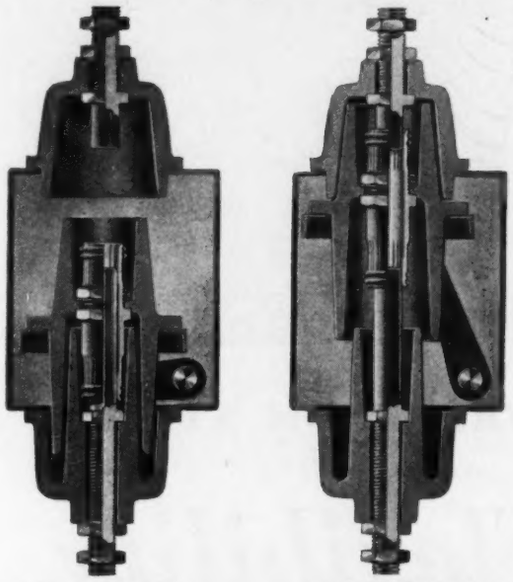
PLANT DISTRIBUTION SYSTEMS

NO BUS SUPPORTS NEEDED
to install this DISCONNECT SWITCH

The contacts consist of an upper stationary stud and a lower stationary stud with a movable middle sleeve always in contact with lower stud and when moving from open position to closed position telescopes with upper stationary stud.

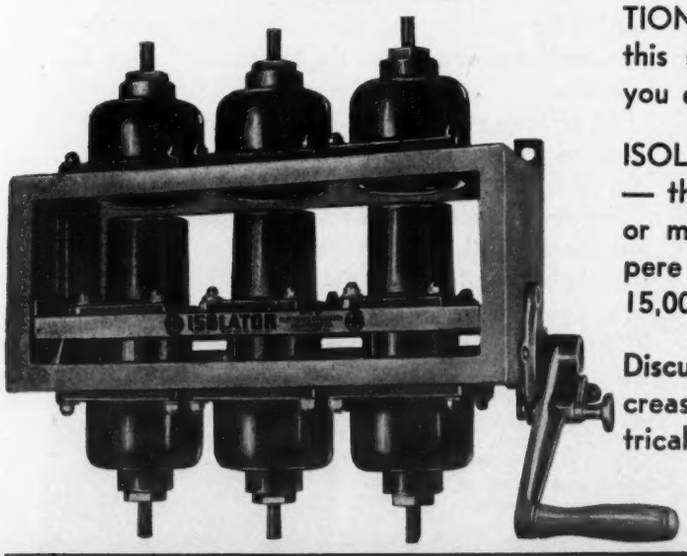
LICK SCARCITIES . . and still keep ENGINEERING STANDARDS HIGH

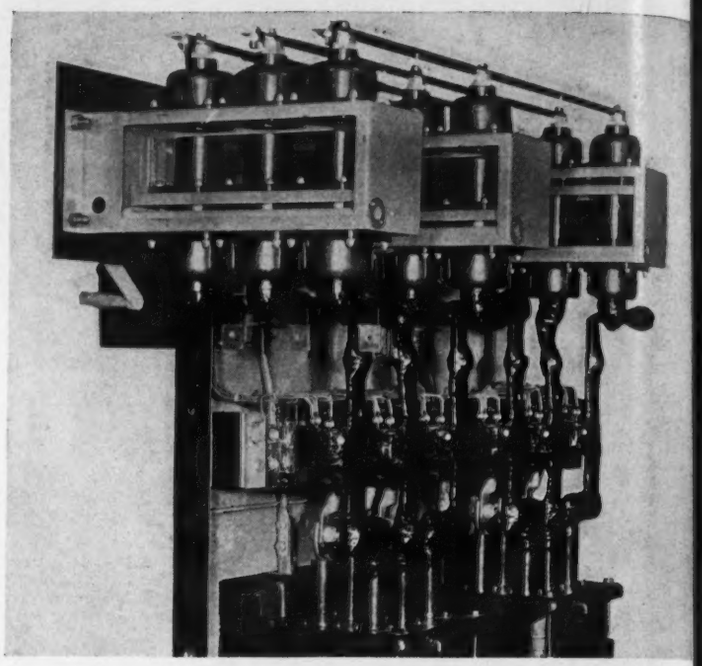
★ The ISOLATOR occupies no more space in open position than when closed. This is because of the telescoping movement of the contacts which occurs within defined limits. Also, there are no live exposed parts.



OPEN POSITION
Note visible open gap.

CLOSED POSITION
Contact made with no overall dimensional changes.





The "THREE E" ISOLATOR is not a new development designed to meet a particular period emergency. It has been in use now for more than ten years. Its design and construction give it a definite place in today's conservation efforts for, the ISOLATOR uses a minimum of strategic materials and helps you to get modern disconnecting facilities with such savings as in SPACE — INSTALLATION LABOR — CONNECTIONS — BUS SUPPORTS — TIME. In addition, with this streamlined gang-operated disconnecting switch, you eliminate WASTE — BARRIERS — ACCIDENTS.

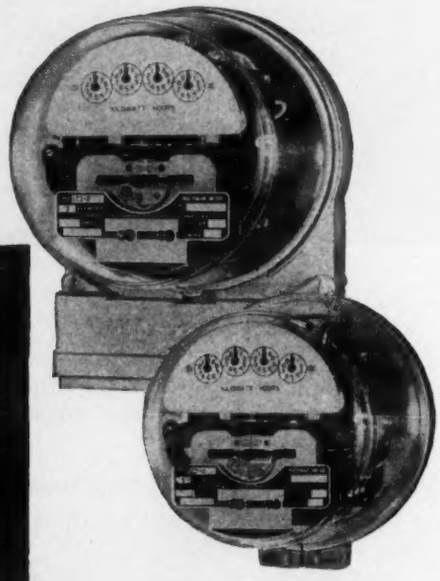
ISOLATORS can be interlocked with other equipment — they can be individually or gang-operated by hand or mechanism, directly or indirectly. Supplied in ampere ratings of from 200 to 2000 and voltages up to 15,000. Other sizes can be furnished.

Discuss this time, material, and cost-saving way of increasing your disconnecting facilities with an Electrical Engineers Equipment Company's representative.

●

ELECTRICAL ENGINEERS EQUIPMENT CO.
MELROSE PARK ILLINOIS

WAR BONDS MAKE
UNCLE SAM MORE
POWER-*full*

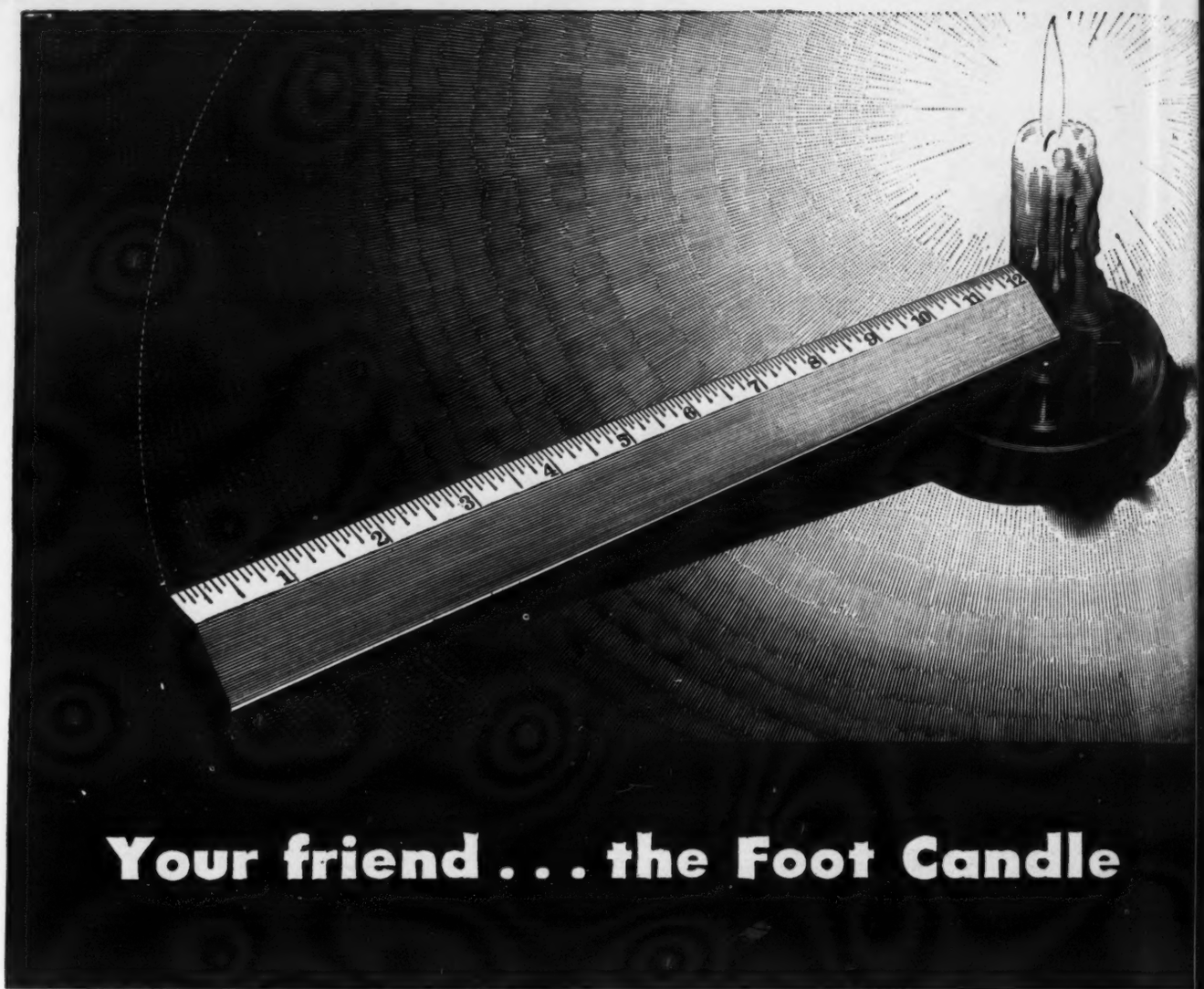


"On Measurement is founded the whole progress of man.."

At the beginning of the twelfth century in merrie old England, where would people turn for the acme of precision? Where, but to the king himself—and so Henry I made the "yard" uniform. There was only one king, so there could only be one yard. The distance from Henry's nose to the tip of his outstretched thumb became the lawful yard. Was the king in good humor and wholly relaxed on that day? Was he measured at dawn or at eventide? No one knows! Yet, that was the conception of standardization. Compare it with today's high standard of measurement of electricity set and met by the electric utilities and the manufacturers of watt-hour meters.

NO OTHER COMMODITY IS MEASURED SO *Accurately* AS ELECTRIC POWER

SANGAMO ELECTRIC COMPANY SPRINGFIELD ILLINOIS



Your friend . . . the Foot Candle

A FOOT CANDLE is the illumination from one standard candle on a surface one foot from the light source.

It is the unit of measurement of illumination. But more than this, the foot candle is man's staunch friend.

In adequate amounts it means his family will have sufficient light in the home . . . he and his fellow workers sufficient light for better, safer factory production or efficient office detail.

For almost 100 years the MILLER organization has known the foot candle on working terms. This lighting experience bridges the broad ground from the whale oil lamp to the modern continuous fluorescent lighting system now helping industry speed out planes and tanks and cannon.

It has involved engineering and design and skill with copper . . . glass . . . steel . . . aluminum and many new non-metallic materials. It has required ingenuity and resourcefulness and pioneering.

It qualifies us to work with those who need better lighting in war industry. It enables us to cooperate intelligently with those who promote better lighting and sell and service it, too. It means that the MILLER engineer (located in principal cities) can serve you in one of several ways, for better lighting today and tomorrow.

THE MILLER COMPANY · MERIDEN, CONNECTICUT

ILLUMINATING DIVISION
Fluorescent, Incandescent
Mercury Lighting Equipment

OIL GOODS DIVISION
Domestic Oil Burners
and Liquid Fuel Devices

ROLLING MILL DIVISION
Phosphor Bronze and Brass
in Sheets, Strips and Rolls

WAR CONTRACTS DIVISION
War Materiel

MILLER
SINCE 1844

G & W POTHEADS

SOLVE YOUR CABLE TERMINATING PROBLEMS

WEBSTER—Pothead (pot-hed) n. Elec.—A form of terminal hermetically sealed to the sheath of an electric cable for making a moisture-proof connection between the wires within the cable and those outside.

G & W POTHEADS more than meet Webster's definition of potheads. They more than provide positive, hermetic sealing against entrance of moisture. They also prevent leakage of compound or cable-impregnating oil. Not just in fair weather and while they're new—but in all weathers and for years upon years. That is the definition of G & W POTHEAD value and service. It is also why so many representative utility companies define G & W as the potheads upon which they standardize.

Send for copy of Bulletin No. 392 which lists standardized potheads.

G & W ELECTRIC SPECIALTY CO.
7780 DANTE AVENUE - - - CHICAGO, ILL., U. S. A.
In Canada—Powerlite Devices, Ltd., Toronto

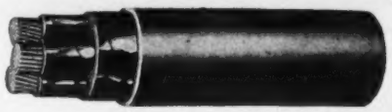
VARNISHED CAMBRIC · RUBBER POWER CABLES · BUILDING WIRE · RADIO WIRES · SIGNAL CABLE · FLEXIBLE CORDS · LEAD-ENCASED AND PARKWAY CABLES · ARMORED CABLE

CRESFLEX NON-METALLIC SHEATHED CABLE · SERVICE ENTRANCE CABLE · MAGNET WIRE · BARE WIRE

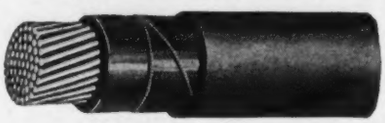
CRESCENT

INSULATED WIRE AND CABLE

Helps to Fill a Vital Need



This is a "Power Age." Power is the gigantic arm of production. 90% of American industry depends on power supplied through Electrical Wire and Cable.



At the CRESCENT plant production is 100% for war purposes. When the war is over, these same unexcelled production facilities, the same skills, the same research equipment, and the same time-tested management policies will remain coordinated to deliver to the Electrical Industry, through regular channels of distribution, the wire and cable that will be needed

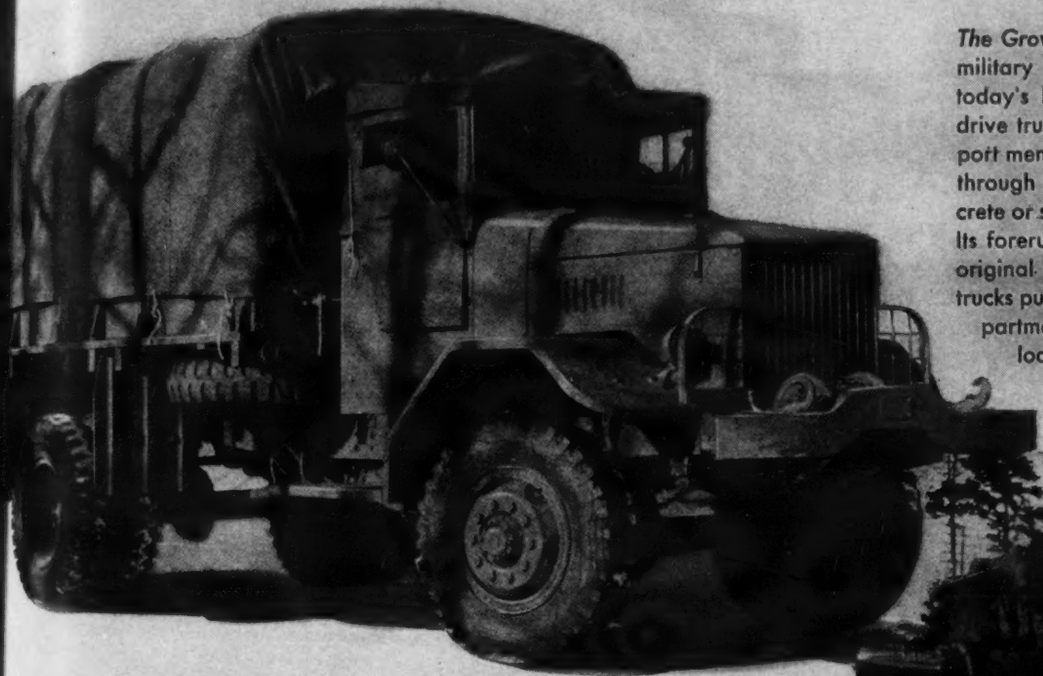
in the future for the peace time expansion that is to come.

CRESCENT INSULATED WIRE & CABLE CO.

CRESCENT
WIRE and CABLE
Factory: TRENTON, N. J.—*Stocks in Principal Cities*

CRESCENT ENDURITE SUPER-AGING INSULATION · WEATHER-PROOF WIRE

Because of the Zealous Faith of an Inventor in His Idea . . . The World has Four-Wheel-Drive Power and Performance for the Vital Transportation Tasks of Today



1943 U. S. ARMY FWD

The Growth Of An Idea: The modern military FWD pictured at the left is today's highly developed four-wheel-drive truck of the type used to transport men and equipment cross-country through sand and mud or over concrete or surfaced roads at high speed. Its forerunner is pictured below — the original FWD, one of the first four trucks purchased by the U. S. War department in November, 1911—as it looked on a test run Feb. 8, 1912.

1911 U. S. ARMY FWD

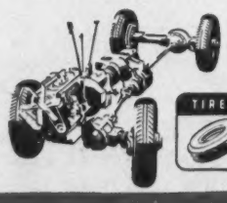
OTTO ZACHOW
1862-1942

The four-wheel-drive principle, which is usually used by the armed forces of the United States and other allied nations in all its combat motor vehicles — from the "jeep" to the largest prime movers — was pioneered and developed in Clintonville, Wisconsin.

Otto Zachow, mechanic and inventor, worked out the ball and socket steering and driving knuckle on each of the front wheels, which is the basis of the present highly perfected four-wheel-drive automotive principle. . . . The original Zachow machine shop, in which the first American four-wheel-drive cars were built, is now maintained by The Four Wheel Drive Auto Co. at Clintonville as a "hall of fame" to the memory of Otto Zachow (1862-1942) — the man whose idea revolutionized military and commercial transportation.

The Four Wheel Drive Auto Company is the oldest and largest exclusive manufacturer of four-wheel-drive trucks—has been building them since 1910 — the finest and most highly developed vehicles of their type.

THE FOUR WHEEL DRIVE AUTO COMPANY
CLINTONVILLE, WISCONSIN
Canadian Factory: Kitchener, Ontario
(The Oldest and Original Exclusive Builders of Four-Wheel-Drive Trucks)



The True Four-Wheel-Drive Principle With Center Differential Asks Less In: Tires — Gas — Oil — Replacements.

IN EVERY FIELD WHERE TRUCK QUALITY IS PUT TO THE TEST — FWD's STAND UP!

COMMERCIAL

CONSTRUCTION

UTILITIES

OIL FIELDS

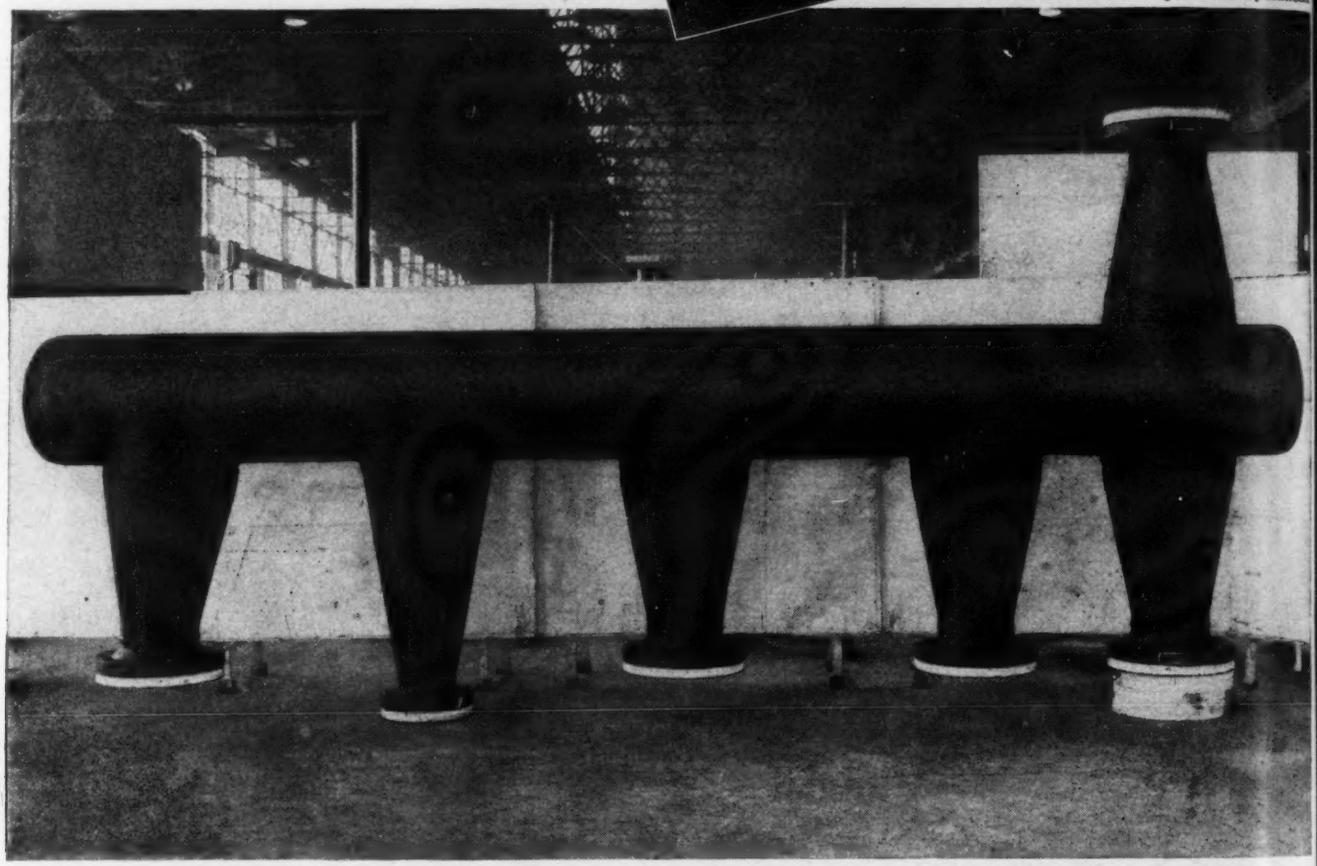
MILITARY

FWD TRUCKS

The Nation's 5th Carrier

FLUID TRANSPORT

From small, intricate process piping to high-pressure headers, Grinnell provides FLUID TRANSPORT to speed war operations.



In the Nation's war-production plants, Grinnell Prefabricated Piping is providing FLUID TRANSPORT for steam, air, gas and liquids – vital services for production.

In power stations, aviation gasoline refineries, synthetic rubber plants, fighting craft and merchant ships, Grinnell has furnished the experienced piping engineering to solve widely varied piping problems.

Grinnell plants, at strategic points, afford modern facilities for fabricating the connecting links which convert a pile of pipe into a complete piping system for efficient wartime FLUID TRANSPORT.

Write for Data Folder, "Grinnell Prefabricated Piping". Grinnell Company, Inc., Executive Offices, Providence, Rhode Island. Branch offices in principal cities of the United States and Canada.

PREFABRICATED PIPING BY **GRINNELL**

WHENEVER **PIPING** IS INVOLVED

Don't Worry

ABOUT THE BAN ON OVERSIZE MOTORS

Copperspun

You don't need oversize anyway when you use F-M Copperspun Motors

The fact that W.P.B. restrictions prohibit the purchase of extra size in a motor is nothing to worry about. Fact is, this restriction will conserve critical materials and *save you money*—because, with Fairbanks-Morse Motors with *Copperspun* Rotors on the job, you don't need extra size or extra horsepower to protect the motor in tough service. You can run F-M Motors with Copperspun Rotors under full load *indefinitely* without danger of damage, because these motors depend on extra quality rather than extra size for their stamina.

The winding of the *Copperspun* Rotor is *centrifugally* cast, in *one piece,* and of *pure COPPER.* Copper has better thermal characteristics. Copper has better electrical characteristics. No other rotor winding is cast of *COPPER.*

Fairbanks, Morse & Co., 600 S. Michigan Avenue, Chicago. Branches with service stations throughout the U. S. and Canada.

FAIRBANKS-MORSE

DIESEL ENGINES
PUMPS
MOTORS
GENERATORS
SCALES
WATER SYSTEMS
FARM EQUIPMENT
STOKERS
AIR CONDITIONERS
RAILROAD EQUIPMENT

F M

Motors

He can smile through it all

So let's keep a smile a-going back here, too.

Even though war is crowding the wires, telephone people still want to give you pleasant, friendly service. Materials for new telephone facilities are not to be had. But there's no shortage of patience and understanding.

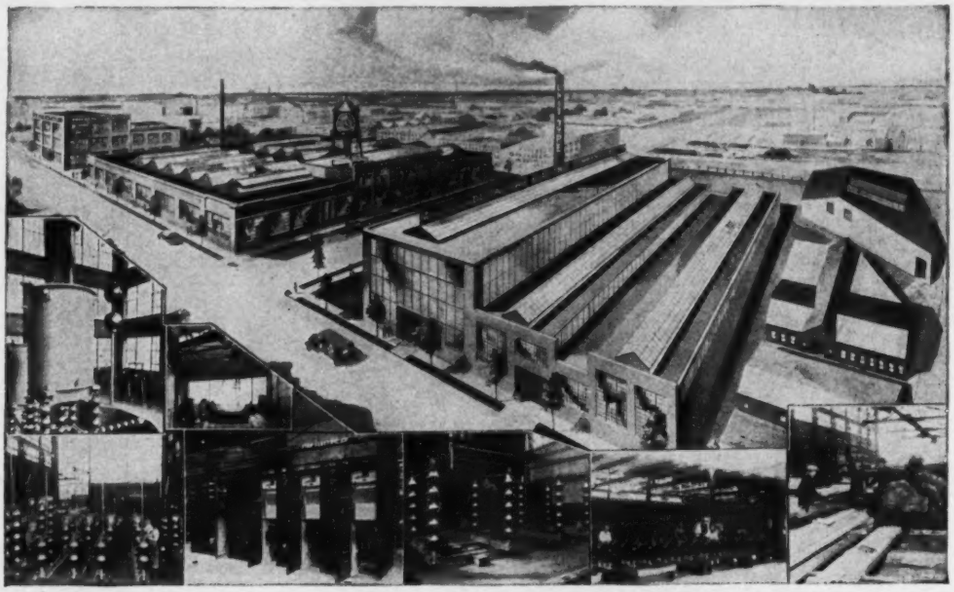
Takes a lot of pulling together to do this and we appreciate the help from your end of the line.

BELL TELEPHONE SYSTEM

WAR CALLS COME FIRST

• Your continued help in making only vital calls to war-busy centers is more and more essential every day.

DELTA-STAR GOES TO WAR!



DELTA-STAR's first duty in the war effort was to supply power switching equipment and switchgear in quantities and on schedule—to help get large war production plants into operation.

This phase of our war effort is about complete. Many war production plants are built and producing beyond expectations — but still greater production is necessary to do the job in the shortest time.

From Switches to Aircraft Parts

From Peace-Time to War Production

Our duty now is to utilize facilities to the greatest possible extent in production of direct war materiel—and we are off to a flying start. Our manufactured parts are now "in the air" on various fronts. More and more will follow until the war is won.

When peace comes again, the knowledge and experience gained from war work will be incorporated in our peacetime production—insurance to our friends that the DELTA-STAR trade-mark will continue to be a symbol of the highest quality switching equipment.

DELTA-STAR ELECTRIC COMPANY

MAIN OFFICE AND FACTORY—2400 Block, Fulton St., Chicago, Ill.
NEW YORK OFFICE—140 Cedar St., New York, N.Y.

DISTRICT REPRESENTATIVES IN THE FOLLOWING CITIES

Birmingham, Ala.	Indianapolis, Ind.	Philadelphia, Pa.
Boston, Mass.	Kansas City, Mo.	Pittsburgh, Pa.
Buffalo, N. Y.	Knoxville, Tenn.	Richmond, Va.
Charlotte, N. C.	Los Angeles, Cal.	St. Louis, Mo.
Cleveland, Ohio	Minneapolis, Minn.	San Francisco, Cal.
Dallas, Texas	New Orleans, La.	Seattle, Wash.
Detroit, Mich.	Norfolk, Va.	Washington, D. C.
Denver, Colo.	Omaha, Neb.	Honolulu, Hawaii

CANADIAN ASSOCIATE

Canadian Line Materials Limited ..... Toronto 13, Canada

Making it hot for Hitler

ONE of Hitler's greatest headaches is America's vast steel production—this year more by far than that of all the Axis countries combined.

The "hot seat" for Adolph is being made especially hot by America's great electric furnaces . . . for they produce the fine alloy steels that make the vital parts of our planes, guns, and ships just enough better to spell the Axis' doom.

These vitally important furnaces depend upon electric current—current which must be delivered unfailingly night and day. Only electrical wires and cables of the finest quality, of the utmost dependability, can be entrusted to this job.

We are proud that products of American Steel & Wire Company play such an important role in delivering power and light to America's vast war production machine. The quality of our electrical wires and cables is no accident. For years and years our engineering and production departments have worked for constant improvement.

And they continue to work on new ideas and developments to take care of the increased wartime demands for power and light and the ultimate conversion to peacetime requirements.

AMERICAN STEEL & WIRE COMPANY

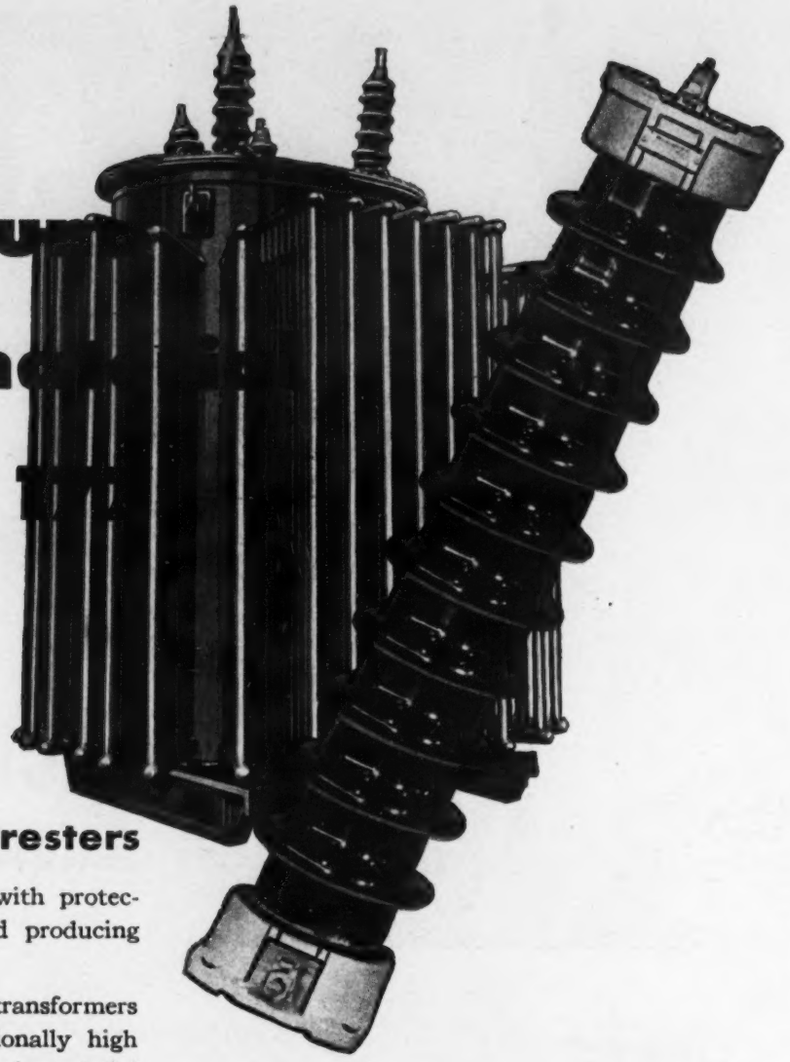
Cleveland, Chicago and New York

Columbia Steel Company, San Francisco, *Pacific Coast Distributors*

United States Steel Export Company, New York

UNITED STATES STEEL

One pou
of critical m
protects



with Westinghouse Autovalve Lightning Arresters

Wartime conservation logically begins with protection of equipment already in service and producing for Victory.

And Westinghouse arresters, guarding transformers vital to war industry, provide an exceptionally high protective ratio—a few pounds of critical material safeguard hundreds. For example:

IN A 1,000 KV-A, 34.5 KV SUBSTATION, ONE POUND PROTECTS 177 POUNDS OF TRANSFORMERS. A PROTECTIVE RATIO OF 1 TO 177!

Adequate lightning arrester protection is but one of the many ways to conserve critical materials that are outlined in the new book, "Wartime Conservation." Send for it today. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., Dept. 7-N. J-60525

Westinghouse

PLANTS IN 25 CITIES... OFFICES EVERYWHERE

WESTINGHOUSE

GET THIS 100 PAGE BOOK

it tells how to . . .

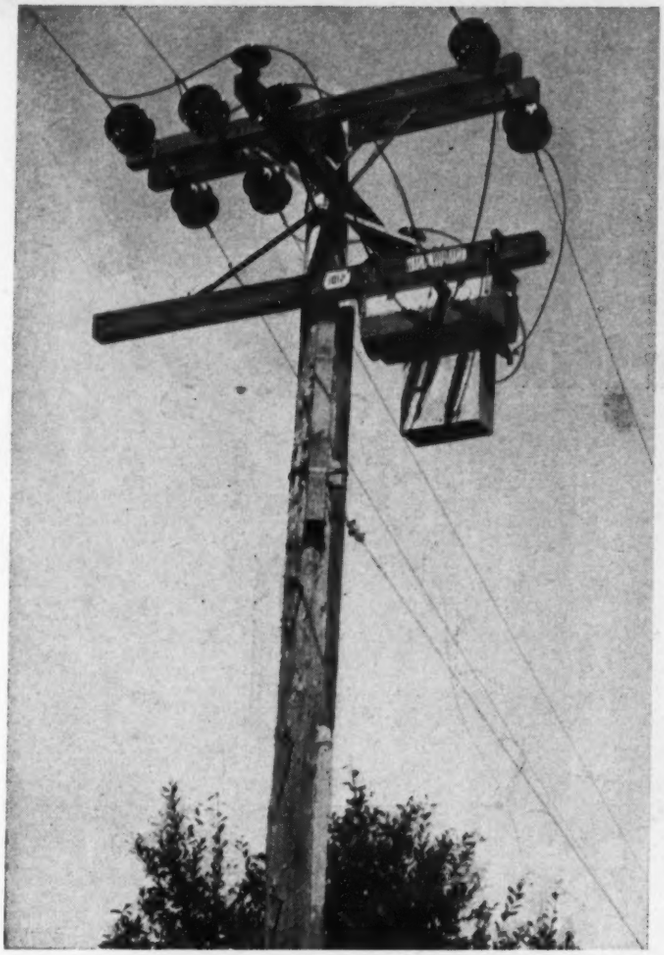
KEEP EQUIPMENT RUNNING through proper maintenance and repair service.

SAVE CRITICAL MATERIALS in the selection, application and use of electrical equipment.

USE NEW METHODS developed by Westinghouse to speed war production.

REPLACE CRITICAL MATERIALS with Micarta and Prestite.

SAVE SCRAP by systematic planning and salvage.



CLEAR FAULTS

Automatically

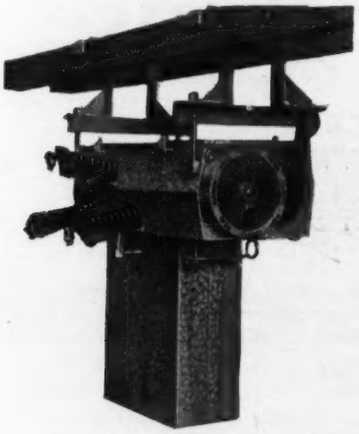
. . . at LOW FIRST-COST

PACIFIC ELECTRIC'S

Automatic Service Restorer

TYPE AP-1, TYPE AP-2 HAND-WOUND

Yours for Immediate Delivery!



Operating energy is stored in a reliable spring, hand wound. It can be re-wound between any faults. Has position indicator. Can be tripped by hand. Type AP-1, 7.5/12.5Y-kv., and Type AP-2, 15-kv., Double- and Three-Pole units, both 100 amps., 60 cycles. Motor-Rewound and Single-Pole Automatic Service Restorers also available.

C. H. Cutter
1015 Securities Bldg.
Seattle, Wash.

U. N. Halliday
230 U. S. Nat'l. Bank Bldg.
Denver, Colo.

G. B. Kirkwood
437 S. Hill St.
Los Angeles, Calif.

Filbert & Fredericks
90 West St.
New York, N. Y.

A. A. Marrs
526 Dwight Bldg.
Kansas City, Mo.

C. C. Musgrove
508 Insurance Bldg.
Dallas, Texas

OTHER REPRESENTATIVES IN PRINCIPAL CITIES

OFFERS THREE-RECLOSURE PROTECTION, EASY TO REWIND BETWEEN FAULTS

Here is better continuity of service for rural or low-revenue distribution lines. You get three automatic reclosures, on transient or sustained faults, before it locks out on the fourth opening.

Between faults, at the convenience of the line patrolman, the operating spring is easily wound by hand, again offering a cycle of three-reclosures protection.

Most of the long outages which so often follow fuse protection are eliminated.

The Automatic Service Restorer offers a selection of predetermined closing-time intervals. It prevents single-phase operation of three-phase equipment because all poles open together, thereby ending dangerous feed-backs.

It is safe. Its construction sturdy, holding maintenance at a minimum. All we claim for this hand-wound Automatic Service Restorer has been proved on scores of utility lines the nation over, under severe storm and ice conditions.

You will appreciate you can have immediate delivery. Write now about clearing faults instantly—at low first-cost.

Pacific Electric Mfg. Corporation

5815 THIRD ST., SAN FRANCISCO, CALIF. DUNES HIGHWAY, GARY, INDIANA

IS THE PORCELAIN THAT INSULATES

POTTERS' WHEEL: 1943. In the Lapp factory, a centuries-old technique in clay handling becomes a fundamental process in production of the world's most up-to-the-minute insulator. It may fairly be said that the Line Post owes its existence to the fact that Lapp clay can be handled by this throwing process. Here air-free clay is worked and reworked, refined and formed, preparatory to the Lapp dry-turning process. To know more about porcelain—and so to produce better porcelain—is the basis on which Lapp claims to produce insulators which will perform better on your lines. May we describe to you the many reasons behind this claim? Lapp Insulator Co., LeRoy, N. Y.

ARMY E NAVY

Lapp

Better Porcelain • Better Insulators

THE CAREFUL INVESTOR JUDGES A SECURITY

BY THE HISTORY OF ITS PERFORMANCE

KERITE

IN OVER THREE-QUARTERS OF A

CENTURY OF CONTINUOUS PRODUCTION HAS

ESTABLISHED A RECORD OF PERFORMANCE

THAT IS UNEQUALLED IN THE HISTORY OF

INSULATED WIRES AND CABLES

THE KERITE INSULATED WIRE & CABLE COMPANY INC

NEW YORK CHICAGO SAN FRANCISCO

TRANSPORTATION—a vital war factor

The effectiveness of our armed forces and civilians alike depends on the efficiency of our transportation

As the battle of Tunisia entered its final phases, with the British and American forces joining hands to crowd Rommel into his last fox hole, Hitler and Mussolini held their twelfth war-time meeting.

One important purpose of this meeting, according to the Berlin radio, was the study of a specially prepared "Survey of Continental Reserves". Topping this list of resources is the item of transportation.

Hitler has a great many headaches these days but, according to no less an authority than the Reich Ministry of Economics, "the central problem of the whole German war effort is transportation". It is, in fact, the Achilles' heel of Germany's War Machine.

The Nazis have become soberly conscious of its crucial importance and Mr. Hitler must wince when he recalls the gigantic miscalculations which led him to neglect his railways.

He counted on a short war, not a long wear-and-tear war and Germany's transportation crisis is getting more critical by the hour. It will play a vital part in its defeat.

This is a war of movement—on land, on sea and in the air. Russia's 2,000 mile battleline, R.A.F.'s 700 mile bombing raids, General Montgomery's 1,500 mile advance last November and the vast area that constitutes the theatre of war in the Pacific make this fairly obvious.

Peace will come when one side gets control over the world's supply of fuel, oil and rubber, for on these three critical materials depend all the vehicles of war—as well as of peace.

An army used to travel on its stomach. Today it travels on its fuel tank.

On the home front, transportation is no less vital. Here it is essential in getting the war workers, their raw materials and their products, to and from the mines, mills and factories that supply our armed forces and those of our Allies. Transportation is a major factor in the nation's ability to out-produce its enemies. Every known method, every type of vehicle becomes essential, for no single group of carriers, freight or passenger, can meet all our needs.

The railroads opened the vast resources of our nation and continue to be the backbone of our transportation system. Today they are doing the greatest job in their history. They are hauling more tons of freight more miles than ever before—33% more than in 1941 and 55% more than in 1918, peak year of the first World War. They are carrying more passengers more miles than ever before—80% more than in 1941 and 24% more than in 1918. They are getting more work out of each car, each engine, and each mile of track than ever before. Private operation of railroads is proving far more effective and efficient in this war than did government operation in the last war.

In contrast to Hitler's Germany, the managers of the American railroads have not neglected their plant except where government priorities forced them to do so. They are turning in an unprecedented performance despite the long starvation period to which they were subjected. During the first World War the total investment in the American railroad plant was about $18,600,000,000. Since then $12,000,000,000 have been spent on improvements and after deductions for scrapped facilities the net increase has been $8,000,000,000. Since the present war in Europe began the railroads have invested about $1,650,000,000 in further improvements, many of them to meet special war needs.

Convincing evidence of the railroads' flexibility in meeting the special needs of all-out war is their performance in coping with the movement of oil to the East Coast. In January 1942, one month following Pearl Harbor, the railroads delivered to the East Coast by tank car less than 100,000 barrels daily. By December they had stepped this up to more than 740,000 barrels and during the week ended April 3, 1943 they

This is the eleventh of a series of editorials appearing monthly in all McGraw-Hill publications, reaching more than one and one-half million readers, and in daily newspapers in New York, Chicago and Washington, D. C. They are dedicated to the purpose of telling the part that each industry is playing in the war effort and of informing the public on the magnificent war-production accomplishments of America's industries.

averaged more than 900,000 barrels per day. By the end of this year they are shooting for the goal of one million barrels a day.

Unlike Germany we have not attempted to control the development and growth of motor transportation according to the "intuitions" of one man but have wisely left it in the hands of experienced competition. That is how our highway transportation system came into being. Growing public acceptance has made it an essential part of our national economy.

The motor vehicle, its limitations set only by the improved highway and the supply of fuel and rubber, has developed to undreamed of proportions. Up to a year ago private automobiles consistently moved more people more miles than *all public carriers combined.* Buses have become an accepted means of mass transportation. Local electric and interurban railways in many cases were converted to bus lines and trucks took over the local freight services. Under these improved operating conditions traffic volume increased. When the war in the Pacific made it necessary for us to conserve our supply of rubber and the U-boat depredations in the Atlantic throttled the flow of gasoline to the eastern seaboard, our motor transport was forced to grapple with the toughest problem that ever had confronted it since it became so vital a factor in the every day transportation.

The "share-the-ride" idea recognizes the need of conserving gas, oil and rubber. This particularly applies to buses, for wherever groups can be assembled for a common destination, buses can be used most effectively. The intercity bus performs for the rural areas the same service that the local bus renders for the residential areas of our cities.

Reorganization of railroad schedules, adaptation of motor transport, rearrangement of working hours, all have contributed to provide a flexible transportation service for men and materials to meet the critical needs of the war effort. Twenty thousand intercity buses are handling 635 million passengers a year which is 69 per cent more than in 1941. The fact that these buses carry a relatively larger percentage of the total coach passenger business than their seating capacity would indicate suggests that here, too, we are getting a more efficient use of these vehicles in terms of passenger loads carried. It is fortunate to note that the geographic location of most intercity bus lines does not coincide with that of the railroads but rather supplements it.

The contribution which the urban transport industry is making to the war effort becomes apparent when we consider that buses, trolley buses and street cars today carry passengers at a rate which promises to exceed the impressive total of 21 billions, as compared with 18 billions in 1942 and an average of 13½ billions for the period 1936 to 1941. And this the industry is accomplishing with a minimum of added equipment and despite a serious drain on its manpower.

The truck lines, too, are setting all-time records. They have rearranged their schedules, eliminated circuitous routes and coordinated their services with those of other carriers. As this is written, contract trucker with the cooperation of the Office of Defense Transportation are trying to eliminate the empty return trip

The transportation industry as a whole is face to face with the biggest job in its history. Increasing traffic loads, with little if any new equipment, difficulty in obtaining essential maintenance materials and a growing shortage of manpower, combine to make it that While federal authorities, acting through the Office of Defense Transportation, took prompt cognizance of this condition, froze equipment and otherwise acted to conserve the vehicles then in service, it was not possible to add sufficient vehicles to keep pace with the increased traffic demand. However, the O.D.T. did lend impetus to the movement for staggering hours of work thereby spreading the peak loads and thus increasing the carrying power of existing fleets of vehicles in city service.

As we review the problems involved in meeting our transportation needs it is evident that we cannot depend upon new equipment alone for their solution. Lend-Lease is taking a considerable share of our much needed output of transportation equipment. The immediate job is up to the rank and file of the transportation industries. It is up to their resourcefulness and devotion to their job. The operating men out on the road, the men in the shops who keep the equipment going, who make the most of the metals and other materials they can have, who salvage, conserve and economize . . . these are the men who must bear the burden of our war load.

Theirs is a dramatic story, a story of cooperation and coordination . . . of ever increasing capacity on a shoestring allowance of new equipment.

For this is a war of movement. According to Joseph B. Eastman, Director of Defense Transportation, both the passenger and the freight traffic on the railroads is to a large extent war traffic – the transportation of troops and civilians on war business, the movement of food, raw materials and finished products required for the prosecution of the war. As Mr. Eastman put it, delayed arrival of troops at embarkation ports, delayed delivery of vital war materials could even conceivably mean the loss of men at the fighting front. And what Director Eastman says of the railroads applies to all forms of transportation. Transportation by bus, by street car, by truck, by train, by ship and by plane . . . all play a vital part in the achievement of victory . . . on the home front and on the fighting front which relies upon it.

James H. McGraw, Jr.

President, McGraw-Hill Publishing Company, Inc.

Taken for Granted

On every hand we hear about the new things to come after the war—plastics, the light metals, electronics. Big things are expected of them, and because of this promise, some of it shrouded in mystery, an aura is created around them. They have romance; they have IT.

Fine! Maybe they and some things yet to be divulged will help us to recreate this physical world—eventually. But in the meantime, what?

Undoubtedly these new materials and products will replace some materials that have been in use for years and years. Maybe some of our basic materials will give way to the new. Time alone will determine that, and this is not the time for any such determination.

If and when the new products replace the old it should be after the new has demonstrated a superiority. In the meantime, what about the old—the material now in common use?

Once it was new. Once it had its promoters ga-ga. Has it no more romance? Or have we become so used to it that we no longer have any real feeling for it—just take it for granted?

Or, worse still, have we forgotten its points? Has it been taken for granted for so long that few people know much about it?

The easy thing, of course, is for people to sit around wondering what is going to happen to them when all these new things are released upon a waiting world after the war. That doesn't butter any bread, however.

The "old lady" can't compete with the new blonde on the next block by going into premature mourning. She'd do a whole lot better by a few visits to the beauty shop and Turkish bath. Maybe then the "old man" would be reminded of some of the things he'd forgotten years ago.

The worst thing that can happen to any product is to be taken for granted. The buyer accepts it and forgets why, because it isn't being sold—it's taken for granted.

When a manufacturer loses the incentive to sell because he, too, takes his product for granted, he little by little stops learning more about it, and if the time is long enough maybe he, too, forgets.

What an ideal set-up for something new—something about which one can get enthusiastic. With all defense down or antiquated, why shouldn't the new have an easy victory, especially when all the populace is looking forward to its coming?

Let the new come. That's progress. But let the outcome be on the basis of "may the best man win" and not by default.

What's Different About Cold Cathode?

Only difference resides in larger electrodes which have lower electron emission rate and thus higher voltage drop, which makes longer tube necessary in order to attain efficiency of operation

A. C. BARR* and C. M. CUTLER,* General Electric Company, Cleveland, Ohio

THE QUESTION most often asked regarding cold-cathode fluorescent lighting is: "How does cold-cathode tubing differ from the hot-cathode fluorescent lamp?" A clearer understanding of cold-cathode tubing as a light source may be gained by investigating three points:

1. Structural and electrical differences between hot- and cold-cathode fluorescent sources.
2. Effect of these differences on design and performance of the respective sources.
3. Resulting influence on application in lighting systems.

Same Cathode Functions

Essential structural difference between the two types of tubes is in the electrodes. The cold-cathode electrode is a fairly large metal cylinder, while the hot-cathode electrode is much smaller and is comprised of a coiled-coil tungsten filament cathode and two small plain wire anodes. (Fig. 1). Even though the arc length in both is the same, measurements show a difference in electrical characteristics of the two sources. The voltage drop across the cold-cathode tube is considerably higher, and wattage goes up proportionately with voltage drop. Glass, phosphor and arc stream may be identical in both types of source, but the electrodes are not the same and this results in their being electrically different.

Function of the cathode is the same in both sources; that is, to give up electrons which, together with the ions they produce, carry the arc current. The cold-cathode operates at about 150 deg. C., while the hot cathode reaches 900 deg. C. The hot cathode is the more prolific emitter because the rate of emission of metals, particularly the alkaline earths used for coating cathodes, increases tremendously when the metals are heated to incandescence.

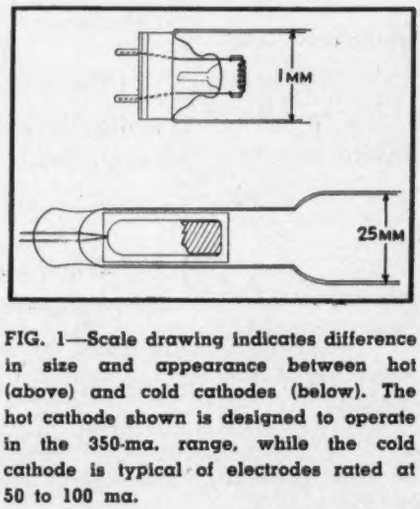


FIG. 1—Scale drawing indicates difference in size and appearance between hot (above) and cold cathodes (below). The hot cathode shown is designed to operate in the 350-ma. range, while the cold cathode is typical of electrodes rated at 50 to 100 ma.

The very high emission rate per unit area of the hot cathode gives it some favorable characteristics. Three important ones are: small size, low voltage drop and relatively high current-carrying capacity. These are obtained at the cost of cathode life, since hot operation is a result of using a cathode wire size small enough to heat up at the current the lamp carries. Being small, the amount of emission coating is limited. This factor, combined with the faster use of the emission material at the higher temperature, tends to limit life.

On the other hand, the emission rate of the cold cathode is low and large area is needed to handle satisfactory currents. Life can, therefore, be very long and little affected by starting. These characteristics are also obtained at a cost, this being high voltage drop and limited current-carrying capacity.

To summarize, hot- and cold-cathode sources are similar except for their electrodes. These differ in that the hot cathode can handle much higher current and has a lower voltage drop, while the cold cathode, although less favorable in these characteristics, is less affected by starting and has substantially longer life.

Effect of Electrode Type

The higher current-carrying capacity of the hot-cathode electrode enables the lamp designer to obtain more light per foot, either by increasing the current in the same diameter tube or by increasing both the current and the diameter.

When the current is increased in a given tube current density increases. The same area of phosphor surface is exposed to an arc of greater intensity, therefore the surface is brighter and more lumens per foot are produced. However, high current densities have some disadvantages; a smaller proportion of the phosphor-exciting radiation is pro-

*Glass Technology Laboratory and Nela Park Engineering Department, respectively.

duced and light output is not so well maintained.

A better way of increasing light output is to use both larger diameter tubes and higher current. Three things happen when the tube diameter is enlarged: First, the cross-sectional area becomes greater in proportion to the square of the diameter; second, the inside wall of the tube, on which the phosphor is coated, increases directly with the change in diameter; third, the voltage drop per foot of arc column is reduced.

Voltage Drop

The lower voltage drop at the hot cathode allows the use of conveniently short lengths of tubing without absorbing a high percentage of the tube volts at the electrodes. Fig. 2 shows this effect for electrodes ranging in voltage drop from 15 volts to 200 when used with 20-mm. tubing operating at 100 ma. The 15-volt drop is typical of hot cathodes, while 100-, 150- and 200-volt drops are representative of various types of cold cathodes.

The charts show that the lower the electrodes drop the smaller the percentage of voltage lost at the electrode for any given tube length.

If hot cathodes are used on a 4-ft. length of this tubing the drop at the electrodes will be 7 percent. If a 10-ft. length of this same tubing is equipped with cold cathodes this loss will be 17 percent for a drop of 100 volts, 23 percent for 150-volt electrodes and 29 percent for electrodes taking 200 volts.

It should be noted, however, that the difference in absolute value of cathode watts loss, in general, is much less pronounced because the high cold-cathode drop is accompanied by a lower order of current. For example, the 40-watt hot-cathode lamp operates at 410 ma., therefore watts loss in the cathode drop is 0.410 x 15, or 6.15 watts. In cold cathodes these figures might be 100 volts times 100 ma., or 10 watts.

Much Still to Learn

The rugged cold cathode does not require starting auxiliaries, thus making feasible simplified wiring and instant starting. The long life of the electrode has its effect on lamp design too, but the importance of this feature cannot be completely evaluated until a great deal more is known about the ability of phosphors to maintain their light output over long periods.

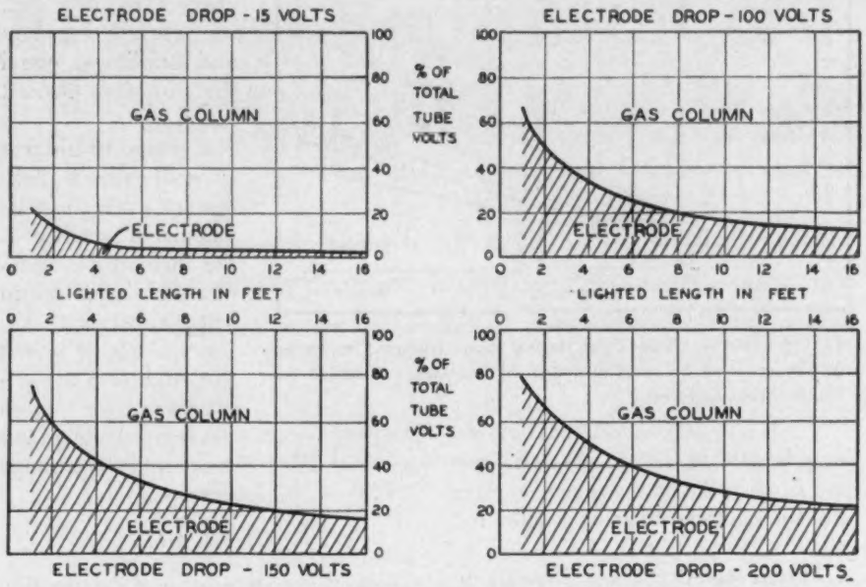

ELECTRODE DROP - 15 VOLTS
ELECTRODE DROP - 100 VOLTS
GAS COLUMN
ELECTRODE
% OF TOTAL TUBE VOLTS
LIGHTED LENGTH IN FEET
ELECTRODE DROP - 150 VOLTS
ELECTRODE DROP - 200 VOLTS

FIG. 2—Lower electrode drop yields higher efficiency in any given length. Distribution of tube volts showing effect of electrode drop for various lengths of 20-mm. tubing operating at 100 ma.

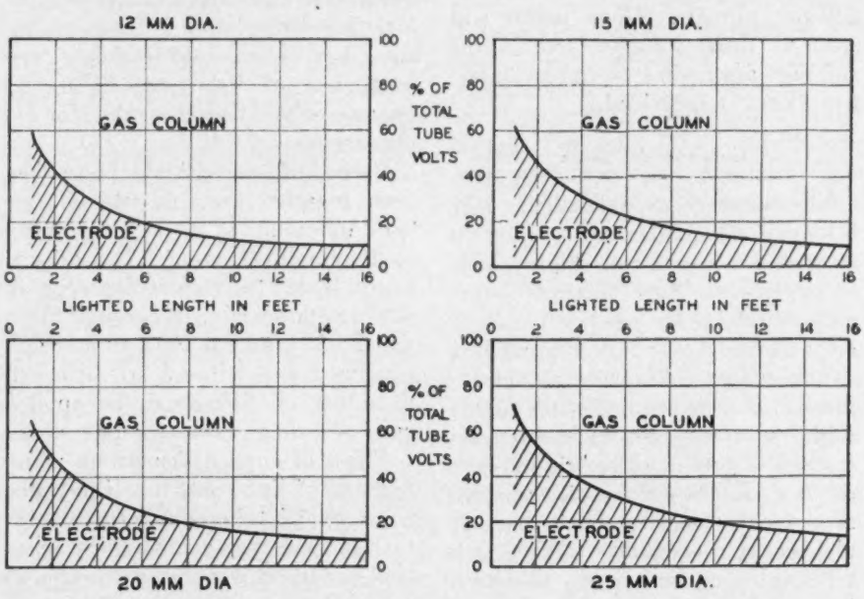


FIG. 3—Longer length is needed to minimize electrode drop when larger diameter is used. Distribution of tube volts showing effect of diameter for various lengths of tubing operating at 100 ma. and with electrode drop of 100 volts

To make use of these features of ruggedness and long life, it is necessary to accept the lower current capacity and higher voltage drop of the electrode. Smaller diameter utilizes lower current to best advantage. Long length can be used to offset the higher drop of the electrode, as shown in Fig. 2 for one tube diameter and current. Fig. 3 shows the effect of length on the percentage of voltage drop in electrodes for a range of tube diameters operated at a current of 100 ma. The length must be greater for larger tube diameters. This is because, with equal current, the volts per foot of arc column decrease as diameter increases. The

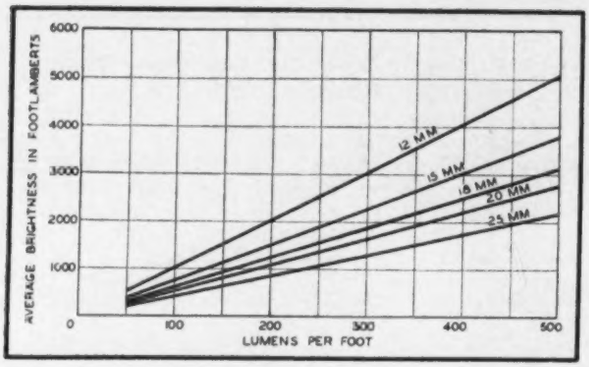


FIG. 4—For a given light output and diameter average brightness may be read directly; calculations are based on inside tube diameter

long length and high electrode voltage drop make it necessary to operate cold-cathode tubes on higher voltage.

This is about the way it sums up: the properties of hot cathodes lead to a lamp that is shorter, larger in diameter, higher in lumens-per-foot output, operates at higher current and on the low potential of 115- or 230-volt circuits. These lamps will start at these voltages, too, if the cathodes are preheated and an inductive "kick" is provided.

Commercial Sizes

The commercial cold-cathode tube is longer and slimmer and is operated in series circuits on high-voltage transformers. More feet of tubing will therefore be needed to do a given lighting job; however, starting switches are eliminated and longer life will also help to offset the higher initial cost inherent in the greater footage of tubing. The brightness of the two sources will not differ for the same current density, but it is a simple matter to operate cold-cathode tubes at low current density to achieve less brightness.

For a given current, the factors of brightness, light output and current density all increase when smaller tubing is used. Table I shows values for a set of 9 to 25-mm. tubes operated at 50 ma. where all are made of the same type of glass, phosphor and gas. The current density of the 15-mm. tube is 0.4 ma. per mm.^{2}; the same as that of the 40-watt hot-cathode lamp operated by its standard auxiliary. Since the densities are the same, the brightness is also the same; this is borne out by visual examination. When the current through the 20-mm. tube is increased to 100 ma., its current density and brightness equal that of the 40-watt lamp.

Average brightness of cold-cathode fluorescent tubing can be calculated readily if the inside tube diameter and the output in lumens per foot are known. Fig. 4 shows the brightness in footlamberts for tubes having outside diameters of 12 to 25 mm. and for a range of 50 to 500 lumens per foot.

Life of Tubes

On the matter of useful tube life, no such simple answer can be given. It is known that all fluorescent sources containing mercury depreciate steadily in light output as they burn. Hot cathodes usually fail before this depreciation becomes excessive, but, when cold cathodes are used, loss of light—not failure to operate—should be the guide for replacement.

Useful life for 10,000 hours has been reported for cold-cathode systems operating at a current density of 0.2 ma. per mm.^{2}. The critical factor is that the rate of depreciation varies with the current density. Since the densities used in cold-cathode systems vary as much as 5 to 1, it is evident that no figure can be applied even as a rough index for all systems.

Effect of current density on maintenance of light output is illustrated by a set of tubes duplicating those used in brightness comparisons. When this second set was burned in a series circuit for 500 hours it was found that the amount of depreciation varied with current density. In the 500-hour period the 9-mm. tube dropped approximately 34 percent in light output, the 15-mm. tube 20 percent, the 20-mm. 12 percent and the 25-mm. about 4 percent.

It should be noted that the values given for lumen maintenance, brightness and light output are for specific sets of tubing. Variations in phosphor, gas, electrodes, etc., would vary the results. The tubes on which the values are given are representative of the best practice and the trends are typical.

Percentages of depreciation would be much greater if the burning period were several thousand hours, though the rate of depreciation becomes progressively slower as the tubes burn. Further, if the largest and smallest diameter tubes were to be operated at the same current density it is to be expected that their rates of depreciation would be substantially the same.

Effect of Type of Source

An important difference in the application of the two sources lies in the fact that the operating specifications of hot-cathode fluorescent lamps are standardized and thus definitely known as to length, light output, diameter, etc., for each size of lamp, while cold-cathode tubes offer a wide choice in these specifications.

With hot-cathode lamps the designer chooses from a limited range of size, brightness, etc., but he is assured of being able to obtain an efficient source and auxiliary equipment in every case. If cold-cathode tubing is selected these characteristics are not settled in advance. The designer has a wider choice not only of length and diameter but of lumens per foot, current, current density and transformer secondary voltage as well. All of these factors will affect the initial cost of the system and its over-all efficiency. Excepting secondary voltage, they will also determine brightness and useful tube life.

In designing a cold-cathode system the first responsibility is to formulate the specifications of the light source. Choice is made within the range of the variables indicated in Table II. A study of this table will reveal that the variables cannot be

Table I — Comparison of Light Output, Brightness and Current Density in One Set of Cold-Cathode Tubes of Various Diameters

Tube Diameter	Brightness in Footlamberts	Lumens per Foot	Current Density Ma. per Sq. Mm.
9 mm.	3,600	240	1.5
15 mm.	1,600	215	0.4
20 mm.	1,000	175	0.2
25 mm.	660	140	0.12

Values are for one set of tubes all made of same type of glass tubing, phosphor and gas.

considered separately; for instance, tube diameter and tube current have similar effect on light output, brightness, life and current density.

No rule can be given for choosing a particular specification. Much depends on the type of lighting desired. For instance, to illuminate a hallway, the designer might find that large-diameter tubing, operated at low current by small transformers, is most suitable, while for lighting showcases the advantages of small-diameter tubes, operated at high current by higher-voltage, more efficient transformers, might be the logical selection.

Some differences between hot- and cold-cathode systems have been those we associate with mass-produced and custom-made products, since, until recently, the high-voltage source was not produced in standard units.

Table II — Variables Affecting Properties of Cold-Cathode Lighting

Variable	Choice	
Tube Diameter	**Large** Higher efficiency Lower brightness Longer useful life More footage per transformer Greater structural strength; fewer supports	**Small** Higher light output per foot Smaller space requirement More easily bent Less footage for given illumination
Tube Current—Current Density	**High** Higher light output per foot Less footage for given illumination value More footage per transformer	**Low** Higher efficiency Longer useful life Lower brightness
Length of Tube Section	**Long** Higher efficiency Fewer electrode housings and wiring connections	**Short** Easier to handle, pack, ship and store Simpler to install and maintain
Transformer Secondary Voltage	**Low** Lower noise level Less rigorous insulating demands Smaller bulk — less obstrusive, if exposed	**High** Higher efficiency More footage per transformer Less wiring

There is now some trend in the direction of standardization of cold-cathode units with advantages for general lighting purposes. At the same time the flexibility of the tubing will continue to make it particularly suitable to the requirements of a wide field of custom lighting.

Blading Repair on a 100,000-Kw. Unit

Sixteen men remove 300 bolts to lift cover, three men cut off 305 damaged blades with special tool and crew replaces cover, all within 42 hours elapsed outage time

C. T. HOYT,* ***Southern California Edison Company, Ltd.***

THE 415,000-kw. Long Beach steam station of the Southern California Edison Company, Ltd., is one of the nation's larger steam-electric generating stations and provides standby protection for the ten southern counties of California in the vicinity of Los Angeles.

Recently a unique emergency repair was completed on one unit in 42 hours, during which the cage was opened, a stage of blading removed and the machine returned to service. The incident developed when a heavy sharp report was heard in the low-pressure section of a 100,000-kw., two-cylinder, 21-stage, tandem-compound machine in this station. This unit has three stages and six wheels in the double-flow low-pressure element.

Inspection

Immediate external, and subsequent hasty internal, examination through exhaust openings failed to reveal the nature of the trouble and the unit continued to operate as required throughout the following 19 hours without dangerous distress. Finally, after removing an inspection plate and making observations while the unit was rotating without vacuum and at low speed, a "rub" was located at the 20th stage wheel on the generator end.

Lifting the large low-pressure turbine cover required a crew of sixteen men and the removal of more than 300 bolts varying from 1½ to 2¼ in. in diameter. Impact wrenches speeded this operation. In four hours the cover was off and the low-pressure section open for inspection and repair.

One 20th stage blade on the generator end, 18 in. long and weighing 1.8 lb., was broken off at the root and was found completely out of the wheel, being lodged in the stationary nozzles leading to the 21st stage wheel. Two other 20th stage blades were broken at the base and held in place by the shroud bands, while shrouding had been stripped from 22 other blades. Damage to adjacent wheels was slight and it was decided to cut off all 305 blades in the damaged wheel at a point 1 in. above their base, leaving the opposing 20th stage blading, together with that on other wheels, intact. The blade roots were left in place to protect the fitted sections on the injured wheel during the period of operation which must elapse before new blading could be procured and installed.

Since the cut had to be made 17 in. below the tip of the blade, the adjoining wheels on either side were so close that working space was extremely restricted, and the intermittent cut of blade after blade imposed a heavy strain on the cutting tools.

Tool Holder Devised

Two steel bars 2x2 in. square were suitably machined at one end to support a hardened steel tool holder so the tool would be located about 1½ in. from the inner end of the bars. The tool holders were drilled for

*Maintenance foreman.

3/8-in. feed screws and the drilled holes drifted to a 1/2x3/8-in. rectangular section for a depth of 1 3/4 in. to receive the cutting tool. High carbon steel cutting tools were secured in the holes by set screws and fed to the work by turning the hexagonal head of the feed screw with a long-handled wrench working in the narrow space between the adjacent wheels. The entire tool holder assembly was supported on top of the lower half of the stationary nozzle diaphragm with its outer end secured to the turbine housing flange by suitable bolts. Three keyways were cut in the lower side of the tool holder bar at the inner end to receive a single key engaging the sealing groove in the supporting diaphragm. By shifting this key from slot to slot it was possible to adjust the assembly to the work as the cut deepened, and longer and thinner tools were used as the work progressed. A schematic diagram of the tool arrangement is shown in Fig. 1, while Fig. 2 shows a section of the blading indicating where the cut was made.

Turning Gear Used

This turbine was equipped with a turning gear which was used to rotate the spindle at a speed of 1.3 r.p.m. A three-man crew using cutting tools simultaneously on either side of the blades completed the actual cutting operation through 1 5/8 in. of blading stock in 9 1/2 hours; a total of twelve hours was required for the entire operation, including rigging and cleaning up. Four hours additional labor by the erecting crew replaced the cover and the unit was again ready for service after an elapsed time outage of 42 hours.

The unit was placed in service without balancing and has continued to operate smoothly at all loads up to 90,000 kw., the new load limit being imposed to relieve overstressing of adjacent rows of blading. As soon as the new blading is received the old blade roots will be cut out and new blading installed; meanwhile, a satisfactory unit continues to do its part toward furnishing power for winning the war.

No doubt there were many other and perhaps better ways of doing this job, but the desired result was accomplished speedily and quickly with the limited equipment available and a crew of "go getters" is ready to take on the next "impossible" thing that requires doing.

Plant Built "Without Benefit of Priority"

Addition of 750 kw. of capacity to the Deschutes system of the Pacific Power & Light Company in Oregon has resulted from the construction of a new plant at Kline's Falls. According to D. R. McClung, assistant general superintendent, by putting the new plant into operation, displacing a 150-kw. plant, the feat was accomplished with practically no demand on critical materials, other than a few specialty items. He describes the plant as having been built "without benefit of priority." To tell part of the story, here is how it was done:

Washington Water Power Company dismantled its old plant at Chelan and Pacific bought the waterwheel. From Washington's abandoned plant at Asotin came the 750-kw. generator of matching speed. The penstock first saw service as one of three 167-ft. stacks at Lincoln station of Northwestern Electric Company in Portland. Reinforcing steel for foundation consisted of old railroad rails, binding straps from an old stave pipe line, etc. Miscellaneous parts from all corners of the system went into the fabrication of the switchboard.

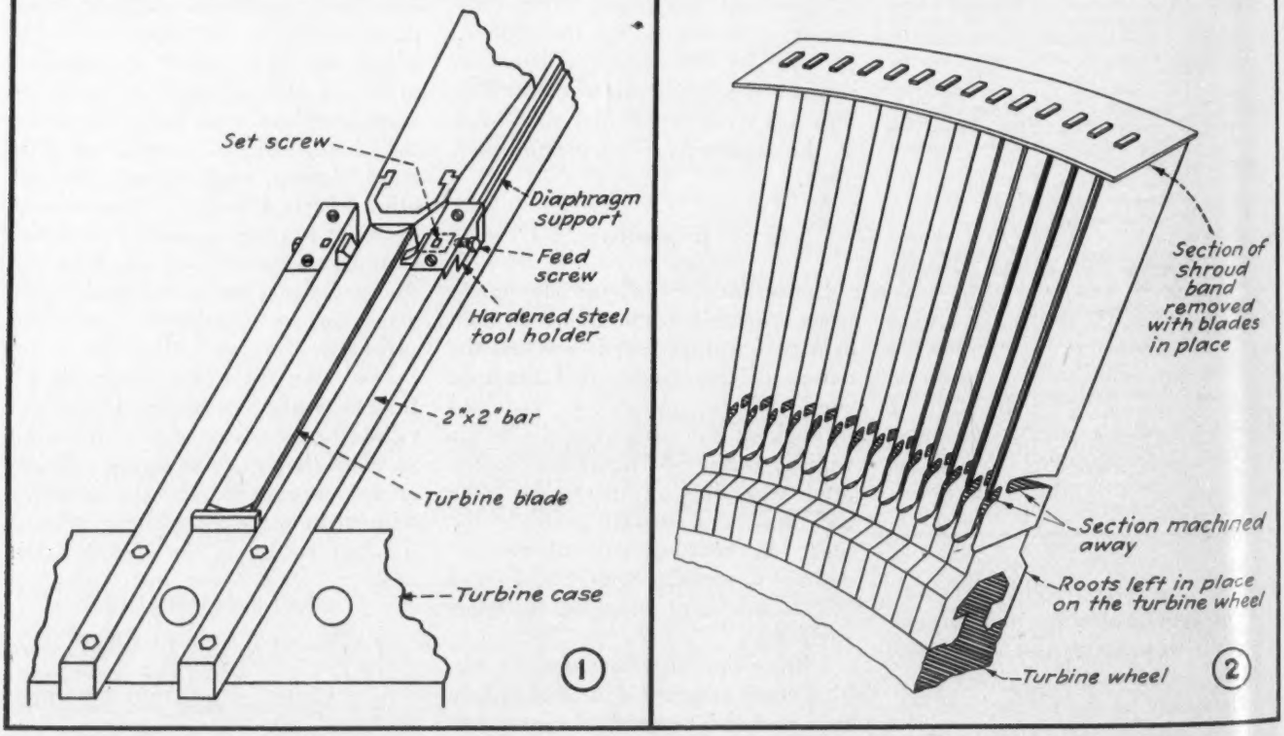


FIG. 1—Tool assembly for cutting off damaged blading in 20th stage of a 100,000-kw. unit (left). Fig. 2—Section of blading showing location of cut

Disaster Can Build Public Relations

Clippings from a New York state weekly newspaper tell an eloquent story of the quick response of people to intelligent storm clearance and fast restoration of service

From January 7 issue of the Cherry Valley (N.Y.) News

1. **Part of front page headline**
2. **Editorial**
3. **New York Power & Light advertisement**

(2)

The Cherry Valley News

"THE PEOPLE'S PAPER"

Published Every Thursday at Historic Cherry Valley, N. Y.

P. LeVERE WINNE, Editor and Publisher

TELEPHONES—Dial 4881 or 3879

$2 per year, in advance. 5c per Copy.

Entered as Second-class matter at the Post Office at Cherry Valley, N. Y.

We're Thankful for the Large Corporations

Praise the Lord for the large utility corporations!

We hesitate to think of what the situation would be in this storm-stricken area, were it not for the fact that the New York Telephone Company and the New York Power and Light Corporation, have unlimited resources to draw from in such an emergency, as regards to personnel, trained repair crews, equipment and material.

The mobilizing of such a large force of men by the two utilities, over 900 in all, the vast stores of material and equipment, would be impossible in the case of privately-owned or smaller controlled corporations. Without these big corporations now, more than thirty communities visited by the greatest ice storm in history, might be without communications and electric service for months to come.

When all other communications to the outside had failed, the telephone company called in their portable radio sending and receiving equipment and within two hours after its arrival, messages were being sent over the air. When practically the entire transmission lines to Cherry Valley from Sharon Springs, of the electric power service laid flat on the ground, cross arms broken from the poles, poles broken off at the ground, the power company put a hundred men at work, with latest repair equipment, and rebuilt the line in the record time of three days. These are some of the miracles that can be done with unlimited resources at one's command.

Little did we realize how much we depended on those two utilities until Nature denied us their use. When phone service failed we had a queer feeling of complete isolation. We dreaded to think of an emergency occurring when we might need the telephone to call a doctor, to enlist help in case of a fire, or to summon help for any need. Very few realized how much we depended upon electric service until the power failed. Oil furnaces and stokers were useless and many homes were cold; refrigerators on which so many depended were silenced; electric pumps left farm homes without water; milking machines were replaced by the old fashioned hand method of milking; houses were 'lighted' by kerosene burning lamps or candles.

Yes, we can truly say, 'Praise the Lord' for the big corporations, especially the utilities. We'll wager you'll never hear another grumble from a resident in this storm-stricken center, relative to policy, rates, or anything else pertaining to the telephone and power companies, for they surely have shown conclusively what it means to be served by a big corporation—big in the sense of resources and personnel, and the eternal doggedness and untiring effort to get our communications and electric service back to normal.

Best of all, when one reviews the situation, considering all the damage—estimated at over half a million dollars, we subscribers to the telephone and electric services, will probably never see it in our monthly bills. It is just one of those things which the larger companies are able to absorb because of reserve funds and foresight in planning to meet any and every emergency, no matter how great.

(1)

ICE STORM DAMAGE GREAT

UNTOLD LOSS OF TREES

Power and Phone Systems Wrecked in Worst Storm in Village's History

UTILITIES ESTIMATE $500,000 DAMAGE—ELECTRIC SERVICE OFF FOR WEEK—800 MEN ENGAGED IN REPAIR — PHONE CO. ERECTS RADIO STATION

One half million dollars damage is the estimated loss to telephone and electric service equipment in the Cherry Valley area, resulting from the storm which visited this section early last week.

Never in the history of the village has a storm equal intensity and resulted in damage occurred. Electric service was cut o... the village was without ... to the outside for about f... Wednesday a broadcasti... talled in The News b... lephone Company, i... ages. The station ... N.Y., Wednesday ... y there, due to los... loss to the shade ... entire village, ca... s. Not a tree o... ght of ice, wh... y the wholesa... reat loss. M... thers are str... lt of there ... lley News ... t week. ... the ten y... ays—Temp... December ... mperatur... chang... in se... 7 ...

Maybe It Was the Storm?

Funeral Director Charles K. Ottman's chickens believe helping in an emergency.

Last week Mr. Ottman gathered an egg which measured 8 inches in length, weighed 1-4 lb., and contained a double yolk.

Such articles are welcome when so many extra men are here, and food is becoming short.

went down with the weight of the ice, and Cherry Valley was completely isolated from communication to the outside. Western Union ... by the storm also. Measurement of ice encas... in diameter. A

500 Trained Men, 25 Car Loads of Poles, 1,000 Miles of Wire to Repair Damage

The New York Telephone Company sent out 900 letters to rural subscribers in the storm-stricken area, under date of January 4, explaining the gigantic task of restoring service, and the amount of materials needed for repair and reconstruction. The letter says in part:

5,000 telephones in thirty communities were out of service.

25 car loads of poles, 1,000 miles of wire, 16 1-2 miles of cable and vast quantities of miscellaneous equipment will be required to repair the storm damage.

500 men are employed in the work, which includes 300 trained employees from all parts of the state and the New Jersey area.

(3)

A Word of Thanks to Our Customers

FOR FURY, intensity and general devastation, there has never been anything in this area comparable to the sleet storm of last week. There have been storms in the past that have wrought great damage, but this one surpassed them all for the extent of the territory involved and for the difficult working conditions it created.

In most places service is now back but there are scattered locations where it will be several days yet before the electricity can be on again. Our crews are getting to these places as rapidly as they can.

What has been trouble for us, has been distress for many of our customers, and we want to pay tribute to them for the way in which they have met the situation. On the part of municipal officials and individuals alike, the cheerfulness, the willingness to help, the sympathetic way that they have recognized our problems and have helped us solve them, have been an inspiration to the men who have been battling to get the power back.

In the territory hit by the storm we have had as many as 700 men working to restore service. These men have been drawn from points throughout the company's territory and have done a job under extremely trying conditions.

Their task, however, would have been infinitely harder except for the magnificent spirit of cooperation displayed by the people of this locality. We are glad to have this opportunity to acknowledge our gratitude.

New York Power and Light

NIAGARA HUDSON

1-5-43

...rk Power & Light ...

...marshalling repair and mainten... power to ...

...Trucks with men and materials ... old of private homes was entirely ...

...before the week was over nearly ... the response was gratifying. Frost's ...

...ere here. One electric company of... Restaurant began feeding the ...

...storm he had encountered in ... is "white." ...

Appropriate Regulator Range—Three Ways of Checking

Conserve investment in regulation equipments by adjusting and applying them most effectively — Data useful for system planning, capacitor decisions, etc. — Observation and graphic-instrument procedures in detail

Regulators Conserved by Graphic Analyzer

E. D. HARTZELL and R. C. THOMPSON
Central Illinois Public Service Company, Beardstown

A GRAPHIC ANALYZER has been developed which produces a graphic strip timechart which shows the range and number of operations of voltage regulators on distribution circuits. The chart shows what portion of the available regulation band is being utilized and the frequency of regulator operation.

By analyzing the graphic charts one can determine if the operation range is such that the regulator may be reconnected for 5 percent operation, thereby advantageously doubling the ampere capacity of the regulator, or, if the regulator could be replaced by a smaller regulator of 5 percent regulation, thereby releasing the larger equipment for use elsewhere.

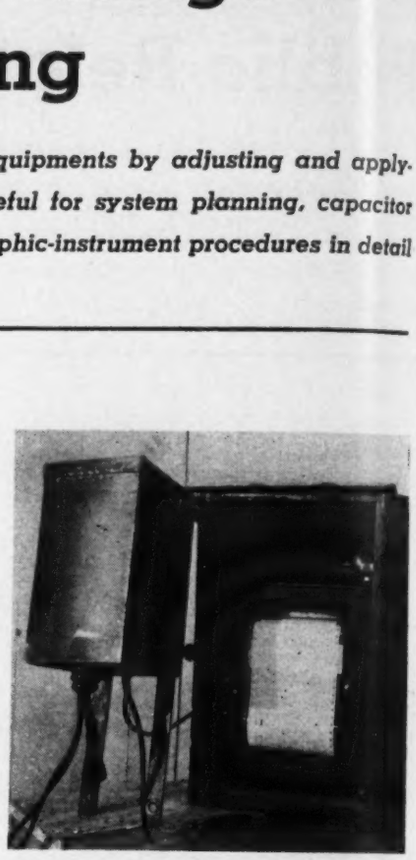


FIG. 2—Potential transformer mounted separate from regulator analyzer

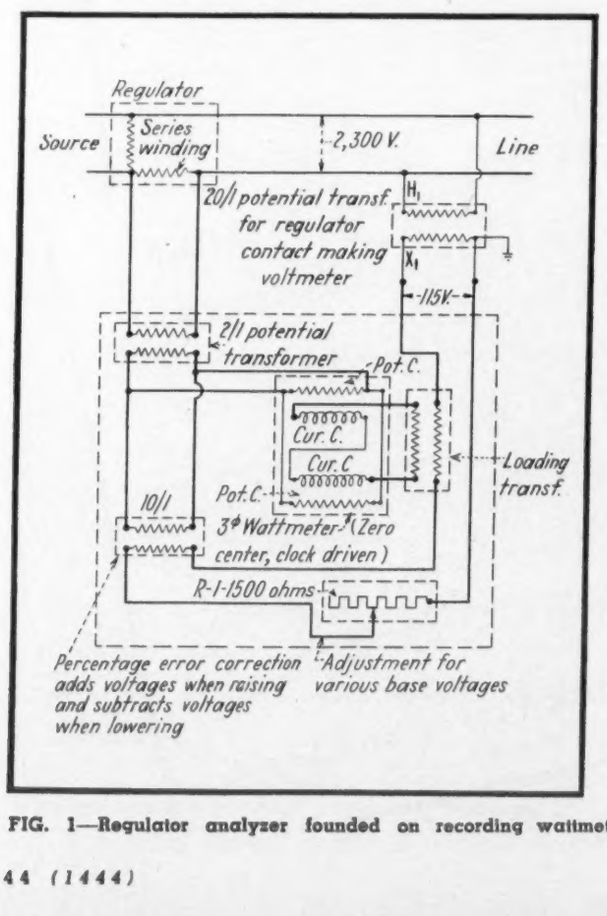


FIG. 1—Regulator analyzer founded on recording wattmeter

Wattmeter is three-phase, zero-center scale with 5-amp. current coils and 115-volt potential coils, scale deflection 500 watts. The potential transformer across the series winding of the regulator has a turn ratio or 2:1 and is insulated for use on 2,300 volts. A standard 20:1 ratio potential transformer usually connected to the load side of the regulator for the voltage regulating relay is used also to provide the current to the loading transformer, which is connected to the current coils of the wattmeter. A 1,500-ohm adjustable resistor in this circuit provides adjustment for various voltage bases.

An error-correcting transformer is used to vary the loading transformer current to compensate for the difference in potential between full buck and full boost positions of the regulator.

Maximum Benefits

It can also be readily determined from the chart if the regulator is operating primarily on the raise or lower portion of the regulation band and if the transformer taps are set to obtain the maximum use of the regulator.

Frequency of operation gives an indication as to whether the contact-making voltmeter's contacts are properly set. In some cases the frequency of operation will definitely point out the need for time-delay equipment, in conjunction with the older type of

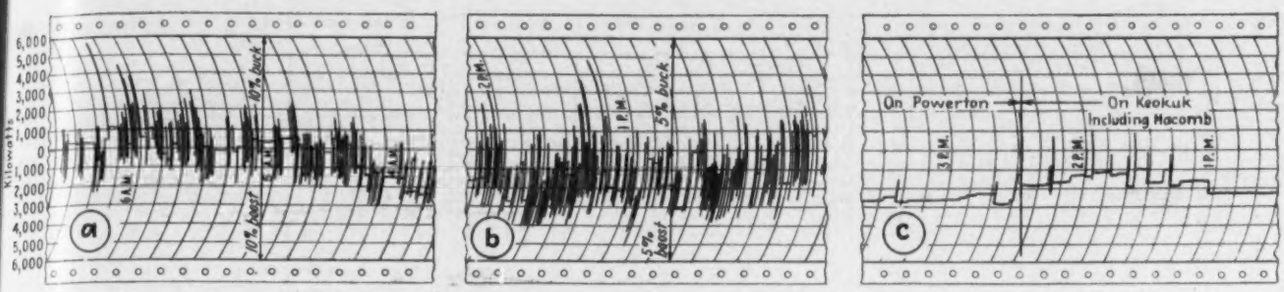


FIG. 3—Analyzer charts aid in decisions on sufficiency of regulators. (a) Regulator can be cut to 5 percent with doubled capacity. (b) Plenty of range with 5 percent regulation. (c) Regulator performance on feed from two distinct sources

regulators that are not so equipped.

In case of system trouble of local nature the charts will aid in diagnosing the cause of this trouble.

The equipment required consists of one recording wattmeter, two potential transformers, one auxiliary transformer, one loading transformer and one variable resistor (Fig. 1).

Example of Interpretation

The following example shows the factors at three different positions of the regulator; *i.e.*, neutral, maximum raise and maximum lower, using a regulating voltage of 2,300 volts as base.

When the regulator is in neutral position there is no voltage across the series winding of the regulator, consequently there is no voltage across the potential coils of the wattmeter, therefore the meter indicator rests at zero in the center of the scale.

At 10 percent boost there is 2,091 volts input, and 10 percent of 2,091 is 209 volts added, which equals 2,300. With 209 volts across the series winding of the regulator there exists, due to the 2:1 ratio potential transformer, one-half of 209 volts or 104.5 volts across the potential coils of the wattmeter. The current coils were set for full scale deflection at 4.34 amp., which at 115 volts gives 500 watts for full deflection.

Error Correction

The error correction transformer adds 10 percent of 104.5 or 10.45 volts to 115 volts, giving a total of 125.45 volts on the loading transformer, thereby increasing the current in the current coils of the wattmeter to 4.75 amp. This multiplied by 104.5 volts gives 496 watts for full scale deflection, which is less than 1 percent error.

At 10 percent buck there is 2,555 volts input, and 10 percent of 2,555 is 255 volts subtracted, which equals 2,300. With 255 volts across the series winding of the regulator there exists, due to the 2:1 ratio potential transformer, one-half of 255 volts or 127.5 volts across the potential coils of the wattmeter.

The error correction transformer subtracts 10 percent of 127.5 or 12.75 volts from 115 volts, giving 102.25 volts on the loading transformer, thereby decreasing the current in the current coils from 4.34 amp. to 3.87 amp. This multiplied by 127.5 volts =494 watts for full scale deflection on a 500-watt chart.

Regulator Range Checked by Annual One-Day Survey

PAUL H. JEYNES, Distribution Planning Engineer
Public Service Electric & Gas Co., Newark, N. J.

ONCE annually a system-wide survey is made over a 24-hour period in order to obtain the following data at half-hourly intervals (hourly intervals from midnight to 6 a.m.) about duty and performance of voltage regulators:

1. Amperes per phase on each distribution circuit.
2. Outgoing volts on each phase on each circuit.
3. Regulator position (percentage buck or boost).
4. Voltage on substation low-tension bus.
5. Voltage on substation high-tension bus.

System Plan Data

Primary reason for making such a survey is to obtain basic data for system planning rather than to check up on mechanical condition such as the adequacy of compensator settings, though useful information of that sort is often a byproduct. In order to meet the rather stringent requirements of the New Jersey Board of Public Utility Commissioners with respect to customer voltages, and at the same time make best use of the large investment in regulating apparatus, careful planning based on adequate data is essential.

Numerous Regulators

The total number of 4-kv. distribution circuits in the Public Service Electric & Gas Company system exceeds 700; all but nine of them are equipped with automatic voltage-regulating apparatus. In most cases this apparatus consists of single-phase induction regulators applied to the individual circuits, though an increasing number of step-type installations have been made in recent years. Usually the latter type has been installed on individual feeders, but at two of the 80 substations 4-kv. bus voltage is regulated by means of tap-changing equipment applied to the transformers. One of the substations having a regulated bus also requires

LOCATION Washington Ave. Substation DIVISION Essex DATE 12/9/41 SHEET No. 1

TIME	Bus Volts H.T.	Bus Volts L.T.	Feeder No. 4001 Amperes A	B	C	Volts A	B	C	Regulator Position	Feeder No. 4002 Amperes A	B	C	Volts A	B	C	Regulator Position	Feeder No. 4003 Amperes A	B	C	Volts A	B	C	Regulator Position
12 M	104	124	90	70	90	124	123	124	2R 1R 2R	120	130	130	125	121	126	1R 4L 1R	110	90	100	125	125	125	3R 2R 3R
1:00	105	127	60	50	60	123	123	124	1L 2L 1L	130	130	145	125	122	125	1L 5L 1L	100	75	90	125	125	125	N 1L N
2:00	106	127	60	50	60	124	123	123	1L 2L 1L	120	135	135	125	120	124	1L 5L 1L	100	70	85	125	125	125	1L 1L N
3:00	107	129	60	50	60	124	123	123	2L 2L 1L	115	120	125	125	120	124	1L 5L 1L	90	70	85	125	125	125	1L 1L N
4:00	107	128	60	50	55	123	123	123	3L 2L 2L	110	110	125	125	120	123	2L 6L 2L	85	65	85	125	125	125	1L 2L 1L
5:00	107	128	50	50	55	123	123	123	3L 2L 2L	100	100	110	125	121	123	2L 6L 2L	90	70	90	125	125	125	1L 2L 1L
6:00	107	128	50	50	50	123	123	123	3L 4L 3L	100	100	110	125	122	124	3L 7L 3L	100	70	100	125	125	125	1L 2L 1L
6:30																							
7:00	107	130	60	50	55	123	123	123	1L 2L 2L	110	110	120	125	123	124	1L 5L 1L	135	100	125	125	125	125	1R N 1R
7:30																							
8:00	107	128	70	60	60	124	122	123	1R 1R 1R	140	135	160	126	123	125	1R 1L 1R	150	125	155	126	126	127	1R 1R 2R
8:30																							
9:00	106	126	190	180	195	125	125	125	3R 1R 3R	180	180	210	130	127	128	3R 1R 4R	140	150	185	127	128	128	3R 3R 4R
9:30																							
10:00	105	125	195	190	200	125	125	124	4R 3R 3R	175	175	190	129	126	126	4R 2R 4R	145	145	180	126	126	127	4R 3R 5R
10:30																							
11:00	106	126	200	190	200	126	125	125	4R 3R 4R	180	180	200	130	128	128	2R N 2R	200	160	200	127	129	128	3R 3R 4R
11:30																							
12 M	104	127	190	175	195	126	125	125	N 1L N	140	145	160	128	126	126	1L 2L N	170	140	160	126	126	127	1R 1R 2R
12:30																							
1:00	105	125	200	190	210	126	125	125	4R 3R 4R	160	160	180	128	125	126	5R 4R 5R	180	135	170	126	126	128	4R 4R 5R
1:30																							
2:00	105	125	215	195	220	125	124	125	4R 3R 4R	190	190	210	130	127	128	4R 4R 4R	145	145	175	127	126	128	3R 4R 4R
2:30																							
3:00	105	126	215	195	220	126	125	125	4R 2R 4R	170	180	190	129	127	128	4R 3R 4R	180	140	170	127	127	129	4R 3R 4R
3:30																							
4:00	106	126	200	180	210	126	125	125	4R 1R 3R	160	160	180	129	126	127	4R 3R 4R	200	160	180	128	128	129	4R 3R 2R
4:30																							
5:00	107	127	130	115	125	125	124	124	2R N 3R	150	150	180	128	125	126	4R 2R 4R	260	200	240	129	129	131	5R 4R 5R
5:30																							
6:00	108	128	130	115	125	124	123	124	N 1L N	145	145	165	127	124	125	1R 1R 1R	235	175	215	128	128	129	4R 2R 4R
6:30																							
7:00	106	126	120	110	125	124	123	124	1R N 1R	135	135	165	126	123	126	1R 2L 2R	240	180	215	127	127	129	4R 3R 5R
7:30																							
8:00	107	128	120	100	120	125	123	124	N 2L N	130	140	170	126	124	126	N 3L 1R	240	170	200	129	129	129	4R 2R 3R
8:30																							
9:00	108	128	100	90	100	124	124	124	1L 2L 1L	130	130	150	126	123	125	N 4L N	220	160	190	128	128	129	3R 1R 3R
9:30																							
10:00	107	127	110	90	100	125	124	124	N 1L N	140	140	160	127	124	126	1R 3L 1L	200	160	180	128	127	129	3R 1R 3R
10:30																							
11:00	108	128	110	100	110	123	123	123	2L 2L 2L	140	130	160	126	122	125	1L 5L 2L	150	130	140	125	125	127	N 1L N
MAX	108	130							4R 3R 4R							5R 4R 5R							5R 4R 5R
	104	125							2L 4L 3L							3L 7L 3L							1L 2L 1L

FIG. 1—One-day substation log carries raise-lower, ampere and volt data on feeders and regulators

supplementary induction regulators on two of its eleven circuits.

Public Service has confined its purchases of regulators mostly to two sizes, 150 and 300 amp., both having plus-or-minus 10 percent regulation. Many of the 150-amp. units can be reconnected for 300-amp., 5 percent operation at a cost of about $75. Since a set of 300-amp., 10 percent regulators cost perhaps $2,000 more than do 300-amp., 5 percent units, a continual search is made for locations where such ratings will be adequate, as well as for locations where existing 150-amp. reconnectable units may be released, and the "position survey" is a means to this end.

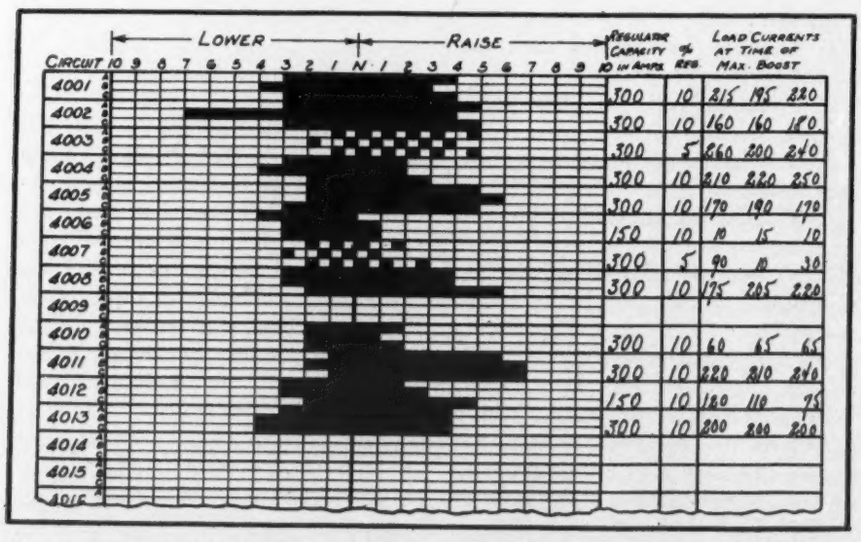


FIG. 2—RANGE of 4-kv. feeder regulators at substation. Maximum buck and boost values for 24-hour period of December 9 (Tuesday), plotted from hourly station (Fig. 1) log data

Added Significance

The data are also used to investigate equipment overload possibilities, which requires a knowledge of input amperes read simultaneously with observations of voltage boost or buck, together with the shape of load curve; such information is of inestimable value under war conditions in an industrial territory. Data are used to determine the most economical measures for over-all voltage control—*i.e.*, whether they should be applied to the bulk supply, as at switching stations; to the substation transformers, as at the two bus-regulated substations, or to the individual feeders, all of which are in use in the Public Service System.

They are essential in anticipating the effect of large shunt-capacitor installations, which now amount to about 135,000 kvar. on Public Service 4-kv. lines, and which have to be shifted frequently on short notice in order to effect maximum usefulness. They have proved useful in engineering circuit reinforcements necessary to accommodate normal load growth,

which in ordinary times amounts to several hundred thousand dollars annually. They are used to establish the proper tap to select on substation transformers in order to compensate for line drop in the transmission system. In brief, the survey is worth while.

Technique of Survey

A sample form (Fig. 1) used for the purpose is attached. In the column entitled "Regulator Position," *R*=raise, *L*=lower, *N*=neutral, and the numbers are read directly from the position indicator, which is customarily graduated from 1 to 10 in each direction from neutral. Feeder ammeters register current on the input (substation bus) side of the regulator; feeder voltmeters are of course on the outgoing side.

In attended substations these sheets are filled out by the regular operators along with the routine log sheets; at unattended substations arrangements are made to obtain readings at least during the day peak period. The total cost of obtaining the record is insignificant.

It has been found convenient to reduce the results to a graphic form (Fig. 2).

The great majority of the regulators have a range of plus-or-minus 10 percent, but there is a considerable number of 5 percent equipments, and a few with 20 percent limits; also, it is necessary occasionally to limit the range of step regulators by applying stops to the actuating mechanism. In order to make it apparent that the limit of travel in such special cases is other than 10 percent, these are plotted in color, while the record for 10 percent equipment is in black.

The day selected for the survey is usually a Tuesday in mid-December, this being the normal peak period for circuits supplying residential or commercial loads, and not far removed from the peak for most industrial power loads as well as for the bulk supply system. The information is thus of greatest value for system planning purposes as well as for the local operating engineers, who are normally engaged in routine investigations of customer voltages and distribution transformer loadings at that time of year, and would require some of the same data in any event.

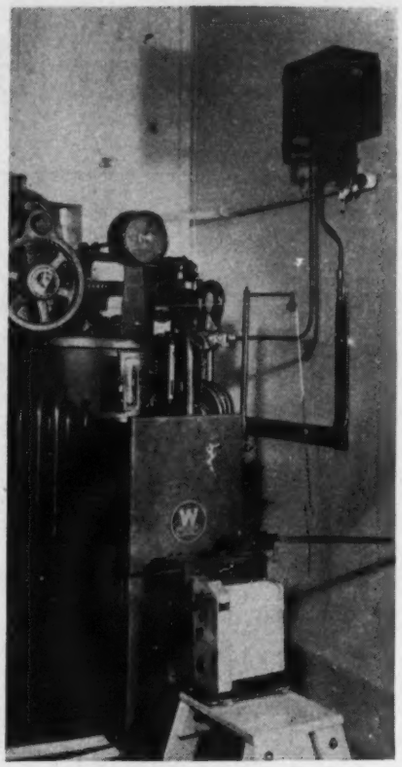


FIG. 1—Lever actuated by cord on regulator shaft moves pen in steps across strip chart to record regulator operation

Mechanical Operation Analyzer for Induction Regulator

ROBERT V. BAKER, Relay Engineer,
Substations Department, Union Electric Company of Missouri

When the Union Electric Company's load began to show an upward trend after the depression years it was found that the load on many 4,160-volt distribution circuits could be substantially increased by the application of static shunt capacitors, located on the primary overhead system, and by the reconnection of the associated feeder regulators in the substation from 10 to 5 percent plus or minus regulation. With the regulator range thus reduced to one-half of its previous amount, satisfactory voltage regulation, in many instances, required utilizing practically the entire range in both directions, which in turn suggested the need for full knowledge of regulator operation and prompted the development of an operation analyzer in order to provide a continuous record of regulator position.

This requirement was met admirably by adapting an Esterline-Angus strip-chart recording instrument (Fig. 1) to be actuated mechanically (Fig. 2) from a moving part of the regulator.

Three In Use

Three of these analyzers have been applied on quite a few circuits, usually to the three single-phase regulators of a three-phase, four-wire feeder. The records obtained are easily interpreted and are very helpful in getting a "picture" of the regulator performance under all load conditions and in determining the value of bus voltage for approximately equal regulator operation in each direction.

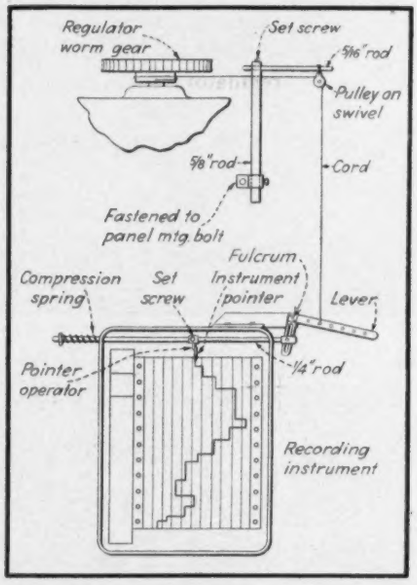
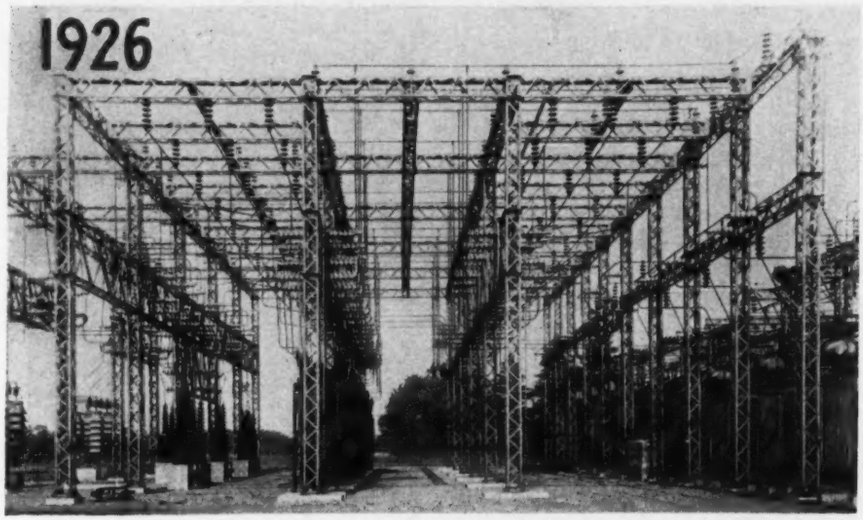


FIG. 2.—With regulator on neutral the pen is set to the middle of the chart scale; travel is adjusted by selecting the proper lever-arm hole; calibration is effected by marking a point for each percent buck or boost as indicated by the regulator position indicator

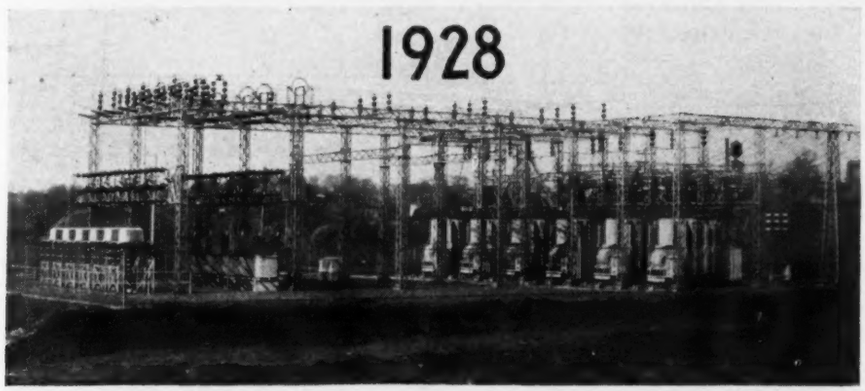
War Stringencies Accelerate

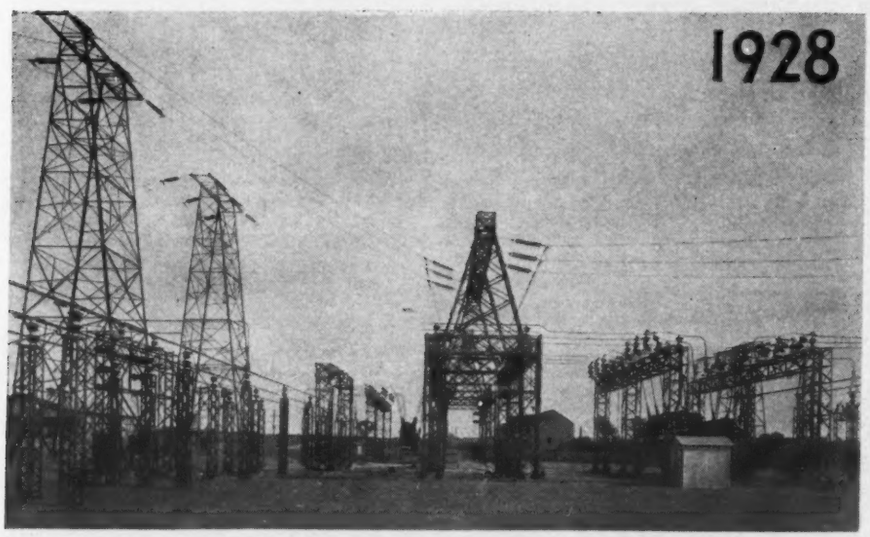


GENEROUS USE of steel and copper in 66-kv. and 33-kv. substations of peace era had already yielded to simplification in war-threat era. Drastic reductions have been accomplished by the Philadelphia Electric Company since America became involved—roughly one-tenth of copper and one-thirtieth of steel originally used.

Substation	Year	Pounds of Copper	Pounds of Steel
1	1926	2,200	32,000
6*	1941	700	10,400
7*	1942	250	1,000

*Including future breaker installation.





1926 66-kv. substation, with 20,000-kva. transformer capacity

1928 60,000-kva., 66-kv. substation

1928 66-kv. substation

1931 33-kv. substation and 30,000-kva. stepdown bank

1940 66-kv. substation with 30,000-kva. bank

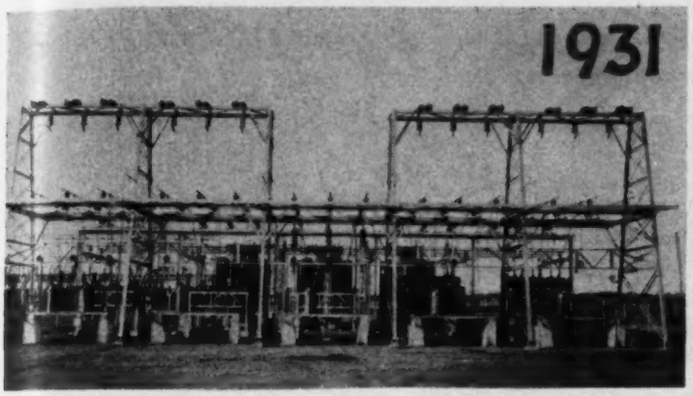
1941 66-kv. substation with 30,000-kva. bank

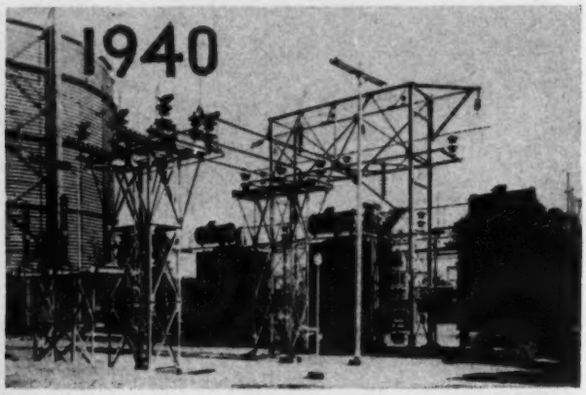
1942 66-kv. substation with 30,000-kva. bank

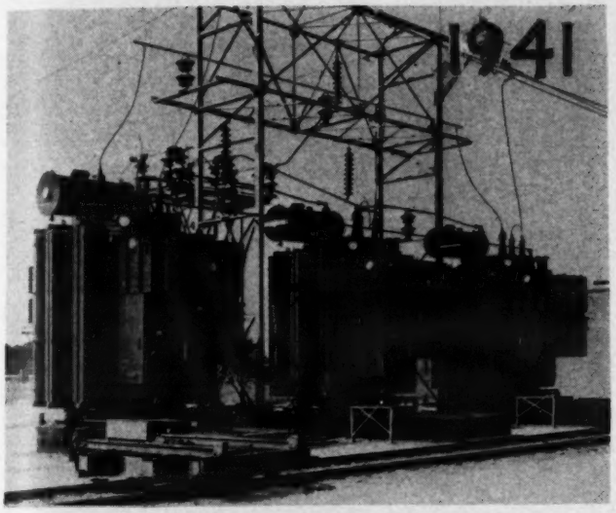
1942 Breaker position in 33-kv. substation

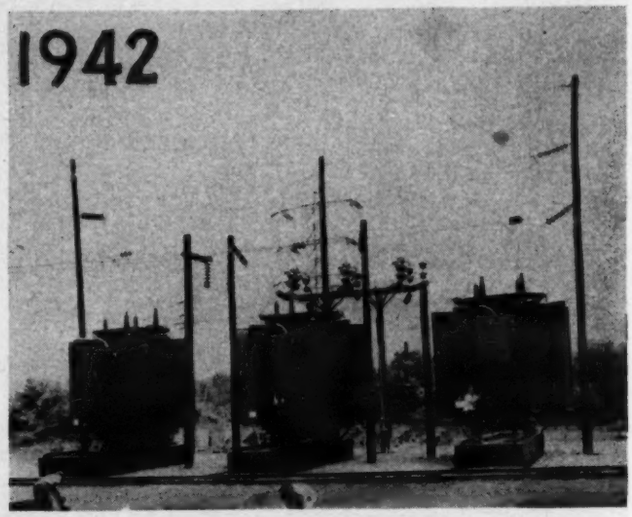
1942 33-kv. ring bus substation

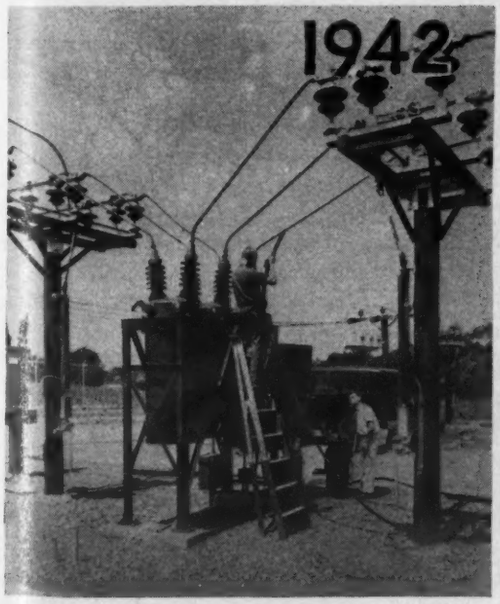
Simplified Substation Design

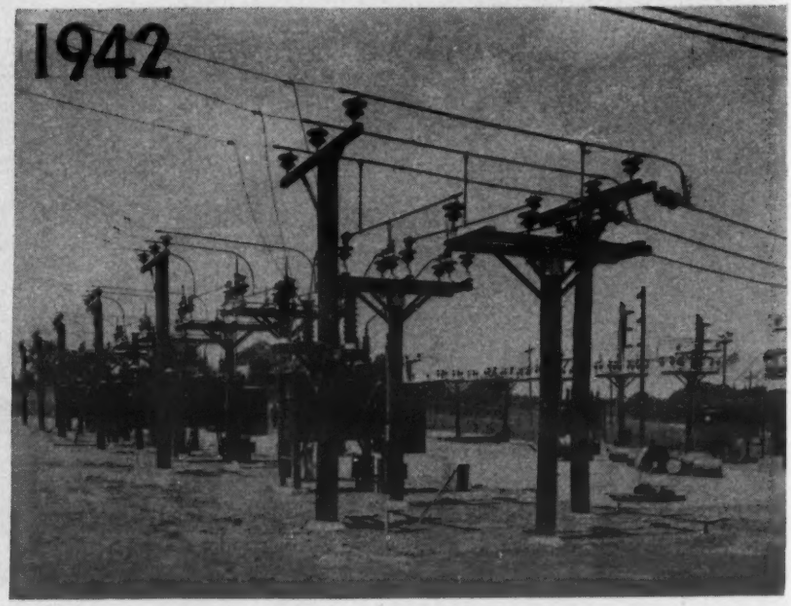












Salvage Wire, Hardware, Lamps, Insulators

Reclamation department of Puget Sound Power & Light Company retrieves conductor material for multiple uses, rehabilitates line hardware and cleans and restores insulators and line accessories

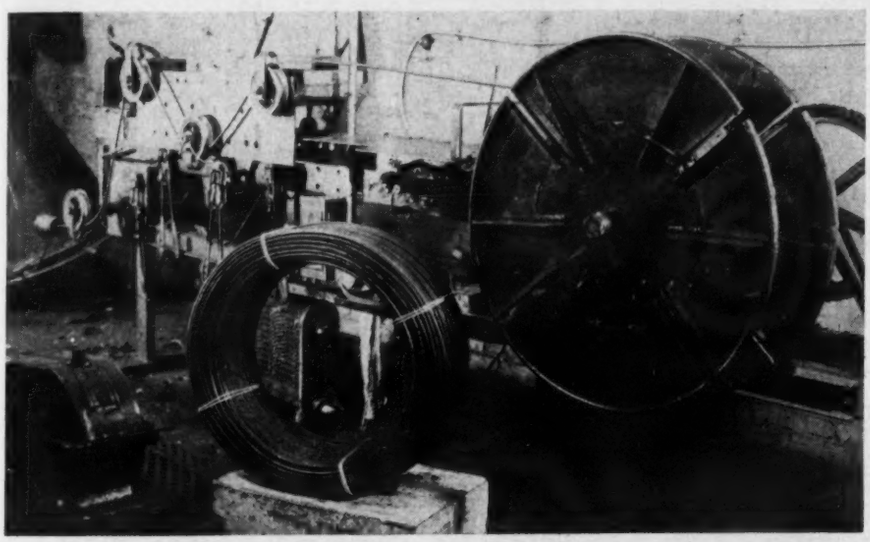


FIG. 1—Splicing and coiling machine consists of a motor-driven reel, with one removable side, to allow removal of the finished coil. The wire is first pulled through a staggered series of grooved wheels which remove all bends and kinks

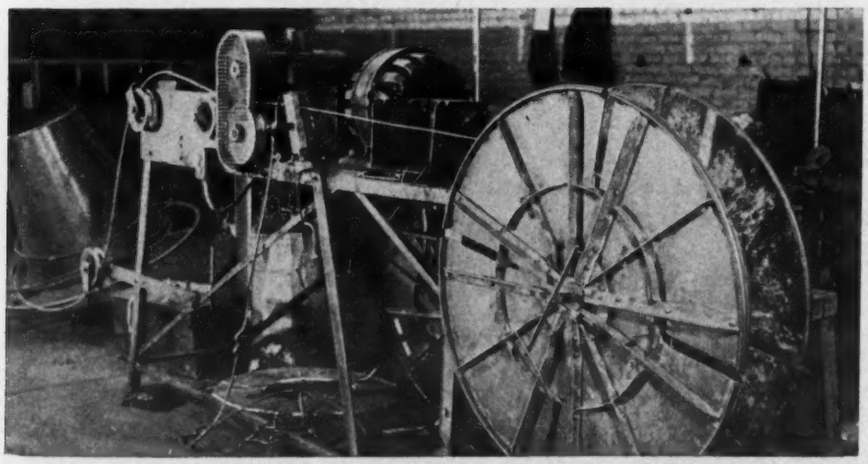


FIG. 2—Wire with ragged insulation is stripped, spliced and used as bare wire

Minimum length to strip economically is about 100 ft. Wire passes between a pair of crushing rolls, adjustable as to clearance to accommodate different sizes of wire. These rolls are motor driven through reduction gears, as is the reel, which is driven by a chain through a friction clutch made up from a Ford brake drum, to accommodate the increasing size of the coil

ESTABLISHED in 1938 to cut down the loss of materials through junking, the reclamation department of the Puget Sound Power & Light Company takes on a new significance under wartime conditions. The original intent was to save waste and make a profit in the operation. The department has always done that and still does, but now the profit motive is subordinated to the sterner one of helping to win the war.

In the reclamation shop routine time and material in reconditioning are charged to one of several expense accounts, the work all being put through on job orders corresponding to these various accounts, which in turn are determined by the last use of the item.

Wire Respliced

Wire is segregated into lots, by sizes and varieties, according to the use for which it will be processed. All automatic sleeves and solderless connectors are salvaged from the wire, later to be cleaned in a solution of Mozel No. 121 (½ lb. in 1 gal. of water), in which the connectors are boiled for ten minutes and then rinsed in warm water to remove any trace of chemical.

Wire with good insulation, but in lengths too short to be used in the field, are spliced with Nicopress sleeves and coiled by machine into coils of from 160 to 200 pounds, ready for delivery to the storeroom. Minimum lengths of wire, having good insulation, which have been found economical to splice are:

No. 8 W.P.	25 ft.
No. 6 W.P.	20 ft.

FIG. 3—Ground coils are spirally wound on the splicing machines, of wire softened in an open fire

No. 4 W.P.	15 ft.
No. 4 H.D.B	15 ft.
No. 6 H.D.B.	25 ft.

Lengths of wire too short to splice or strip are worked up into tie wires, transformer leads, corner jumpers and ground coils, which are used in place of ground rods where new poles are being set.

After coiling (Fig. 3) the ground coils are stapled to a wooden slat, leaving 8 ft. of loose end to be brought up for attachment to the transformer ground wire brought down the pole. Enough wire is used so that the surface area will be about equal to that of a §x6-in. ground rod. When wire larger than No. 1 is used for a ground coil an 8-ft. length of No. 4 is brazed to the coil, using Silfos, to be brought up for attachment to the transformer ground.

Hardware Reclaimed

All hardware is inspected, straightened where necessary, rethreaded and galvanized by electroplating with pure zinc. Provided the ends are not too badly damaged, all bolts are rethreaded on a Beaver pipe-and-bolt-threading machine. Bolts having ends too bad to be rethreaded are cut back, leaving the threaded portion a minimum of 2 in.

After these operations, the hardware is descaled and rust removed by pickling in Oakite Compound No. 32, using one part Oakite and four parts water, the pickling period being six hours.

The larger pieces, such as large bolts, braces and metal embedded in porcelain, are placed in an open vat, from which they are removed and scratch brushed with a motor-driven wire brush before going into the galvanizing tank. Smaller items are tumbled during the cleaning process in a motor-driven hexagonal drum, equipped with baffles, which is half submerged in the Oakite solution. This eliminates scratch brushing on the smaller items. The drum is constructed of ironwood, but it is believed that a metal drum would give long service provided it were removed from the Oakite and rinsed after use.

Cleaned hardware is galvanized in a solution of 44 lb. of C.P. crystallized zinc sulphate, 8.8 lb. of pure crystallized sodium sulphate, 2.2 lb. of C.P. zinc chloride and 1.1 lb. of crystallized boric acid, dissolved in 100 quarts of water.

The coating of zinc will build up to 0.003 in. in about three hours, which seems to be the proper coating for all purposes. It has been found that with a potential of two volts a current of 15 amp. for each square foot of surface materials in the plating tank gives best results.

Insulators Rehabilitated

All porcelain and glass insulators are cleaned in one of two solutions. House knobs, usually daubed with paint, are cleaned with Oakite, Test X. This is an alkali base and will not harm the galvanizing on the hardware, as would an acidic type solution. Insulators covered with the usual carbon-like deposit are put into a solution of Ircosol No. 67, which readily removes the deposit. Care must be exercised in the strength of the solution and period of the bath, as it has an acid base and will etch glass and the glazed surface of the porcelain. One part Ircosol is used to from two to four parts of water, depending upon the amount of deposit to be removed, leaving the insulators in the bath for approximately one-half hour. Rubber gloves are worn by the operators during this work.

Ground molding and stubbing band staples are made from No. 6 galvanized wire, cut diagonally to length on a shear and then shaped by being bent over a form of the proper size.

FIG. 4—Lightning arrestor bushing reclaimed for use as wall bushing; ring of drilled holes leaves shoulders for mounting

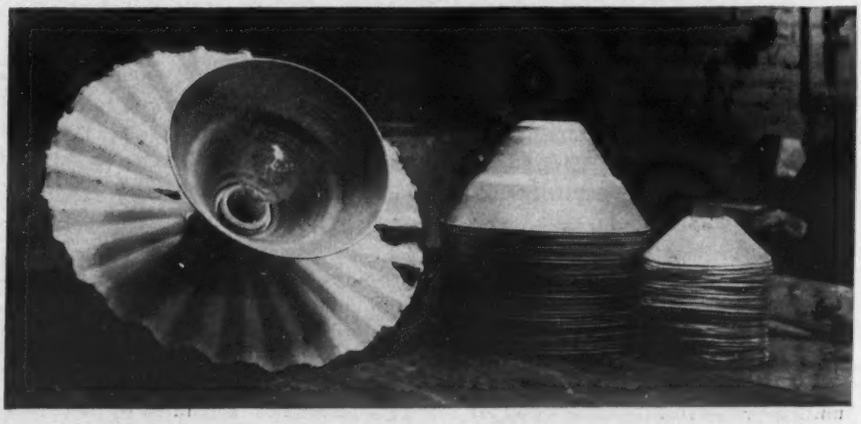


FIG. 5—Lightning arrester cones reshaped to fit socket below regular reflector to convert street lights (series or multiple) to dimout requirements

PRIORITIES PROBLEMS

Getting Short Item Supplies

Case No. 52

The procedure outlined in Case No. 32 (ELECTRICAL WORLD, November 14, 1942, page 79) by which utilities are enabled to acquire stocks of "short items" of material when they are "long" in inventory has been changed by Utilities Order U-1. Inquiries received by the Office of War Utilities from companies which have, say, an overstock of wire but no supplies of a needed type of conductor indicate that there is still some misunderstanding about the changed regulation.

Gone entirely, under the U-1 procedure, is the provision of the old Order P-46 authorizing automatic purchase of up to 5 percent of a company's delivery quota in "short items" regardless of inventory of a particular class of materials. Instead of this 5 percent automatic purchase allowance, there is now no limit to the proportion of "short item" purchases within the delivery quota. But there are several specific requirements which must be met by any company wishing to purchase supplies of a "short item": these are outlined in Paragraph F-5 of Order U-1.

In the first place, Order U-1—for the first time—specifically defines a "short item" as any item of material which, considering the company's inventory, will be needed for repair, maintenance or operations authorized by the order within 90 days of its delivery. As an illustration, take the case of a utility whose stock of No. 6 bare copper conductor is enough for only six weeks of permitted maintenance. No. 6 bare copper wire, therefore, is a "short item," and under Paragraph F-5 the company may order additional supplies even though the total dollar value of its wire and cable inventory exceeds the Paragraph F-2 working minimum.

Before purchasing the additional wire, however, Paragraph F-5 requires that the company classify on its books every item of inventory in its possession which exceeds the practical working minimum inventory prescribed in Paragraph F-2. This record must be made not only for excess wire and cable, but also for excess supplies of all classes of material. The excess material must be continuously held for sale to other utilities or "financially responsible persons" authorized to buy it under the provisions of Paragraph I. A report of the excess stocks available for sale must be made to the Office of War Utilities when, and in the manner that such report is called for—the Order U-1 amendment of April 17 makes it unnecessary to report the surplus until requested to do so.

The segregation of working inventory and excess stocks doesn't require a physical separation of the materials, nor does it require a duplicate set of books. But the classification must be clearly identified and complete.

Having made the required inventory record, the utility may place orders in the normal manner for the additional wire needed, or for other items of materials of which its stocks are below a three-month supply. There is this further restriction: If an item of inventory has been marked as excess stock and made available for sale and then is retransferred to the possessor company's working inventory for use in repair and maintenance it must be charged up as a delivery just as if the item had been purchased. And the total of items withdrawn from excess inventory for the company's own use plus the value of "short item" material purchased may not exceed the delivery quota set forth in Paragraph F-1.

Reducing Paper Work

Case No. 53

Supplemental Utilities Order U-1-d eliminates the necessity of considerable paper work for utilities in connection with extensions to serve buildings and houses which are built under approval of WPB's Construction Division. It is no longer necessary to obtain advance permission where the connection can be made within the provisions of U-1-d; only a letter certifying that this can be done is required.

There are two classes of service extensions which utilities are given blanket authority to build by this order. One involves service to rated industrial or commercial buildings which can be installed by using not more than 60 pounds of copper. The other is residential services for approved housing which can be installed within the limits of the WPB Housing Utilities Standards.

In either case, instead of preparing the utility service application for submission to the Construction Division along with the contractor's application for authority to build (the procedure outlined on these pages before issuance of U-1-d—ELECTRICAL WORLD, November 28, 1942, page 61), the utility simply addresses a letter to the Office of War Utilities stating that the service can be provided within the limits of U-1-d. This letter is supplied to the contractor or the housing agency when they ask for it; there is no need to do this until called upon.

What happens if the service extensions cannot be made under U-1-d? The procedure then remains the same as before. The builder applies to WPB for authority to erect the structure of housing project and, when he is so requested, the builder asks the utility for an application covering the service extensions. In the case of a hous-

IN ALL CASES where utilities need "controlled materials" for an extension costing more than $1,500 for underground construction or $500 for other types of construction, a request for a CMP allotment number must be filed on a CMP-4C form in addition to the regular procedures (see Case No. 53, above) for obtaining authority to make the installation. However, don't file the CMP-4C until informed that the application for "controlled materials" submitted by the builder of the structure to be served has been approved. Then send the CMP-4C direct to the Office of War Utilities.

ing job where the materials required exceed the Housing Utility Standards, the utility should use the PD-545 form; for other types of structures, the utility application is prepared in letter form, supplying the data required in Paragraph E-2 of Utilities Order U-1.

These utility applications are forwarded to the Office of War Utilities. Most housing extensions exceeding the standards still are turned down, but permission is sometimes given for a building extension which exceeds the 60-pound copper limit where this can be shown to be necessary.

Utility service extensions to unrated houses or buildings likewise still require special handling. Utilities, in these cases, apply direct to OWU on a U-1 withdrawal letter for permission to withdraw the necessary materials from stock if they are on hand, or on a PD-1A form if materials need to be purchased.

Formulas Under CMP

Case No. 54

There is considerable difference between the procedures which should be used by utilities for obtaining controlled material under the Controlled Materials Plan and for obtaining specified end products which contain these materials. Frequently, in filling out CMP-4C forms, companies fail to recognize this distinction with the result that applications must be returned and the project is delayed.

CMP regulations contain a long list of products, mostly items required by many industries as distinguished from custom-built equipment, which are classified as Class B products. All other use of controlled material forms of steel, aluminum and copper is, by CMP definition, for a Class A product. When utilities require controlled materials for a Class A product they must obtain a direct allotment of controlled material. When, however, they need a Class B product all that is necessary is authority to build the project in which the equipment will be used; the procedure of obtaining allotment of controlled materials for the Class B product is carried out by the supplier.

Often utilities will be dealing both with Class A and Class B products in constructing a project—as an illustration, an addition to the boiler plant. First step is, as always, application by the utility to the Office of War Utilities on a PD-200 project form (or a PD-1A if only a small job is involved) for authority to undertake the work, and a priority rating. After this is obtained, the utility then prepares a CMP-4C application asking for allotment of the necessary controlled material for other than Class B products—the structural steel, etc., to be used. This application also goes to OWU, which will issue a CMP allotment number for the approved quantities of aluminum, steel and copper. The allotment number, together with the project priority rating, is passed along to suppliers with purchase orders in the regular manner.

In filling out the CMP-4C, however, the utility must not apply for an allocation of controlled material to be used to fabricate the boiler or any other parts and equipment to be installed at the job which are listed in CMP regulations as Class B products. Only the project rating need be given the boiler manufacturer for use on his CMP-4C application for controlled material to make the unit.

As often as possible, OWU eliminates the paper work and time consumed in the second utility application by preparing the CMP-4C blank in Washington and issuing an allotment number for controlled material for non-Class B product use along with the project rating. This can be done where the job is relatively simple and the utility's original PD-200 or PD-1A application clearly shows what controlled materials are needed for Class A product use and when they will be needed.

Schedule C's $100 Minimum

Case No. 55

Strictly speaking, the $100 figure in Paragraph J of Utilities Order U-1 applies individually to each type of material listed in Schedule C, rather than to the aggregate value of a utility's order.

DON'T WRITE to the Office of War Utilities in Washington with questions pertaining to OWU's inventory redistribution program set up by Paragraph J of Utilities Order U-1. Take the inquiries to the regional office in your area (for locations, see ELECTRICAL WORLD, March 20, page 83). OWU has set this program up on a decentralized basis and has given regional officials the necessary field authority so that answers can be obtained more quickly.

Illustrating the distinction is the inquiry from a utility company which needed relatively small quantities of automatic line splices (Item 17 in Schedule C), wire (Item 1), and suspension insulators (Item 12). The dollar value of each of the three items was less than $100, but the total order was considerably in excess of that amount. The company's question was:

Is it necessary to go to the regional office to attempt to get these items from excess inventories of other companies before ordering from the supplier?

The answer is no; utilities must clear through the regional offices only when the dollar value of an individual item on Schedule C exceeds $100. In replying to the inquiry, however, the Office of War Utilities pointed out that the purpose of the inventory redistribution program is to put to work excess stocks of material in utility inventory so that it is considered helpful to the war effort if an attempt is made in every case to secure the needed items from other companies.

MRO-U Correction

The Controlled Materials Plan symbol MRO-U assigned in Utilities Order U-1 for use by utilities in obtaining "controlled materials" for repair, maintenance and operating supplies is used on orders for all items defined as "controlled materials" in Schedule 1 of CMP Regulation 1.

In the last paragraph of the Priorities study outlining the step-by-step procedure for acquiring materials in the April 17 issue of ELECTRICAL WORLD (page 74) it is incorrectly stated that the MRO-U symbol should be used only on orders for the types of "controlled materials" listed in Schedule B of Order U-1. Schedule B lists those items of "controlled materials" of which utility construction inventories are limited to a 60-day supply under Paragraph G of the order.

Editorials

S. B. WILLIAMS, *Editor*

Mortality Among Small-Business Men

FIGURES on numbers of electric customers are startling in their revelation of mortality among small businesses. In each of the twelve months ended with February the number of small retail light and power customers decreased with one exception. The aggregate loss was close to 150,000. These figures would be considerably higher were it not for the springing up of large numbers of concessions around Army posts and big war plants.

The small business is the backbone of American prosperity. It is the opportunity the average citizen has to make a living for himself with independence. The war in its rationing of supplies and food is making it increasingly difficult for him to remain in business.

Some threats to curtail sign and store-window lighting are causing further consternation among the ranks of small-business men. Because they do not have the volume or capital to advertise the same as their large competitors, they have found the cheapest and most effective advertising to be electric signs and lighted show windows.

To the ordinary individual, both these forms of lighting probably seem unessential to the war effort, but when viewed as necessary by small stores perhaps it would be well to pause a moment before making decisions.

There would be a definite saving in coal transportation if signs and show windows were turned off. Would the saving be worth the loss of the small business man?

Clearance for These Unfinished REA Lines

JUST ABOUT the time that Clyde Ellis was being defeated in the Arkansas primaries for United States Senator the foundation for his new job was unwittingly being laid by WPB in its order halting work on unfinished REA projects. It wasn't long after that that Ellis signed up with the new association of REA co-ops.

He wanted these projects restored. Two weeks ago he got what he wanted.

In releasing these projects it was stated that the material was all in inventories except some 750 tons of steel wire. Whose inventories? Did the new lines projects have the material in inventory or are they expecting to get it from private utilities?

Mr. Nelson is reported to have said that "from a practical standpoint no other use exists for these frozen stocks comparable to the benefits to be obtained from completing the electrification of these projects." Is this a new policy on excess inventory? If so, why shouldn't private companies be permitted to build new rural lines as a "practical" matter where excess inventory exists?

It has been one of the policies of the Power Branch that it will play no favorites, so in spite of the great pressure that has been brought on WPB right up to the top to get favorable consideration for completion of the co-op lines that were held up it would seem to us that this latest action needs some amplification.

Once before WPB bowed to pressure for an REA line in Arkansas although the Army engineers and the state commission had ruled against it. This action was definitely discriminatory and the results have in no way justified the action.

In wartime only one policy should prevail, which will help the war effort the most? If it is the "practicality" of using excess inventory, or if it is the "practicality" of which will provide greater food production, it seems to us that some different kind of order might have been issued.

Post-War Merchandising at a Profit

ONE of the pre-war problems that is causing some post-war planning difficulty is the question of utility merchandising at a profit, or at least without loss. To a department store or any other retail executive the question seems to have no point. And it would be pointless were it not for the fact that utility merchandising departments are frequently loaded with costs that do not justly belong to them.

The merchandise department is not free to pick store locations, but it may have to pay a rental that is higher than it would pay for a better location. Inventory warehousing, delivery service, repair policies, demonstrations, character of salespeople and training are not necessarily what would be chosen by an independent merchandiser. Accounting and executive overheads outside the merchandise manager's control eat into his profits.

It is fruitless to debate the question of whether or not a merchandising department can make a profit until there is a better agreement on what constitutes justifiable costs.

Some companies have these costs properly allocated, while others are still laboring under cost loads that handicap the sale of anything but high profit wares. This

would seem to be a good time to review merchandising cost allocations to the end that post-war merchandising be done under more equitable conditions.

Inverted Thinking

THOUSANDS OF LADS with a 60-cycle background are undergoing the unique experience of inversion. They're in the Army and becoming familiar with ultra-high frequency operations. One of them recently wrote back to his office what at first glance reads like the ravings of a d.t. victim:

> Here are some of the things you run into after you start up on the frequency scale from 60 cycles. Copper begins to hold less of an attraction for you as a conductor—in fact, porcelain looks pretty good. Two pieces of wire about a couple of feet long, open at one end and connected to a generator on the other, short-circuit the generator. The reverse is true; tie the two ends together or short them with a copper rod and you open circuit the generator. By adding or subtracting a couple of inches to these wires they suddenly become perfect condensers or inductances. A perfectly good inductance at 60 cycles may become an excellent condenser when you go up a little way. A condenser, of course, always can be counted on to be a good inductance. A resistance may turn out to be anything, an open circuit, a short circuit, a capacitance, or inductance. Physical shapes no longer mean a thing. In fact, right away you learn how silly you were to think of using two wires for single phase when one would have done the trick just as well. A broomstick would be swell for this . . .

But these aren't the ravings of a distorted mind. They come from a mind that has had opened to it a brand new vista. When that lad and thousands of his fellows return to their old jobs at the power companies will they be content to fall back into 60-cycle operations, or will they be on the search for some way to bring this ultra-high frequency into their power work? Obviously there can be but one answer.

We have made a start in higher frequencies, such as film fusing of steel plate, thermo-setting of plasticized wood, glass welding. We have used radio frequencies for communication and control. And when the boys come back, maybe we will go to still higher frequencies.

A Greater Problem Than Holding Company Evils

IN REPORTING to the Texas Legislature a special committee set up to investigate the San Antonio purchase of the local utility and the part paid by two river authorities said: "Under the guise of flood control and reclamation projects, these River Authorities, if they follow the policies set out by the present management, may eventually present a greater problem than the holding company evils with which we have had to contend in the past."

Texas doesn't stand alone in this. A river authority seldom expands because of a need for more power in the area. In fact, it expands despite the fact that a market is non-existent at the time when the project is started. Therefore, in order to have a market it feels forced to absorb all competition within what it conceives to be its area of operation.

When expansion is unnatural and forced it is likely to carry with it grandiose ideas on the part of its promoters which are frequently irregular. For instance, one finds little regard for economy during any forced expansion. It is not unusual to find many hands dipping into the treasury. Fees are enormous—in fact, it is probable in a great many instances that the fees were responsible for the expansion.

These were the things the national government found so very wrong in holding companies and to prevent which the Public Utility Act with its death sentence clause was enacted eight years ago. But the law didn't stop it—only changed the cast.

There is a difference, however. This time it is the public's money that is being dealt out so lavishly. This time the system that is being built up is subject to no regulation. It even tells municipalities what they can charge for service.

If cities and states thought they were being fettered by absentee control of utilities under holding company ownership let them envision their situation under absentee control by a political agency.

Voltage Regulator Analysis

DOES any particular voltage regulator anywhere on a system have buck and boost range enough to care for the voltage correction which is needed because of today's greater loads? Maybe it has enough to do as good a job as is demanded today in wartime even if the resulting regulation is not up to pre-war standards, or, better yet, it may have a margin of current-carrying capacity that would permit either its removal elsewhere or a reconnection of coils in parallel to increase its load ability and still give respectable boost. In either event, it is quite necessary to know what duty is now being imposed on the regulator and how well it is performing.

There is little excuse for overtaxing a regulator in one situation beyond its thermal capacity and, in another place, having one underloaded and underdutied. To avoid such wastes there are instrumental methods and there are observation analysis methods of getting the facts about feeder regulators. These are discussed in detail elsewhere in this issue.

Such specific information has usefulness beyond the mere exigencies of wartime. It has significance for the much broader question of system planning in that it indicates what incoming bus voltages should be. That voltage can be established by straight life or it can be established by manipulation of reactive. That's where the decisions are reached as to optimum balance of generator capacity devoted to reactive, or bus-lumped and distributed capacitors, of supplementary tap-changing, boosters and step devices.

Washington Comment

By RICHARD LARKIN, Washington Staff

Excess Inventory Jumble Over Handling Charges

SHALL "handling charges" be included in the price at which certain items of excess utility inventory shall be sold?

This problem is a source of concern to three federal agencies and to innumerable business enterprises which are being prodded to buy this idle material rather than to burden war producers with the fabrication of additional equipment.

The three federal agencies concerned are OWU, the Redistribution Division of WPB and the Office of Price Administration. OWU enters the picture through its control over utilities, which have large stocks of excess inventory, and through its basic Utilities Order U-1, which requires utilities seeking certain items to try to locate them in the excess stocks of other utilities before going into the open market.

Formula Needed

Redistribution Division enters the picture as the WPB agency primarily assigned to the job of getting idle and excess inventories into use. Its viewpoint on the matter, in the main, reflects the attitude taken by leading materials divisions of WPB, such as Steel and Copper, which have the actual responsibility for effecting allocations from inactive inventories under WPB Priorities Regulation 13. OPA assumes an integral part in the question because it must set the pricing formulas under which excess inventory is sold.

The problem of flushing out excess inventory would be relatively simple if all inventory were registered in one central office whose files were kept up to date, if the amount of inventory to be regarded as excess were established and catalogued, if the right to buy a given item in the open market were denied to all prospective purchasers as long as that item was to be found in excess inventory, and if there were no qualifications as to price.

The problem, however, is not that simple. Although Redistribution has developed central clearing houses for critical materials, covering the inventories of a majority of holders, the problem is one of finding a formula which satisfies the requirements of all the agencies concerned. All these agencies are united in attempting to solve this difficult problem.

OPA on the Side Lines

OPA has evacuated its position in the middle of the OWU-Redistribution Materials Divisions discussions for the sidelines. It feels that when the WPB agencies concerned can get together on the formula for excess inventory pricing it can write the regulation without much hesitation.

This leaves the matter up to OWU, Redistribution and the materials divisions. None has yet been able to think of a simple solution.

Root of this problem is found in OPA's Maximum Price Regulation 204, the regulation governing transactions under Regulation 13. That Redistribution is deeply concerned with the broad policy of inventory allocations under Regulation 13 is obvious. Thus, it works closely with the materials divisions, which look to such allocations to supplement mill production. Any interference with these allocations is Redistribution's problem. The issue, then, arises out of OWU's difficulties with MPR 204.

No Way to Absorb Costs

OWU has difficulty with MPR 204 because, having jurisdiction over excess inventories of new wire and cable, the regulation establishes the maximum price for this equipment as the current open market price. This maximum, which requires a certain amount of trouble to determine, makes no provision for the inclusion of handling charges incurred in purchasing, receiving, storing and accounting for the material between the time of its original purchase and its sale as excess inventory.

In presenting its case, OWU argues that inclusion of this handling charge is standard cost accounting practice in the industry. Regulated fore and aft as it is, the industry's rates are based on costs which must be figured against stipulated criteria. These criteria are never easy to change, and, under the present "hold-the-line" theory of rate setting, probably could not be revised upward to account for the losses incurred in selling without a handling charge. So utilities are hit in the pocketbook when deprived of handling charges on excess inventory sales.

Then too, publicly owned utilities, of which there are thousands in the water field alone, are governed by relatively inflexible law. For them, selling without a handling charge is not only a question of losing money but also of breaking the law.

Would Restrict Flow

The Redistribution and materials divisions, for their part, are anxious to help settle OWU's problem—but not at the expense of the over-all movement of idle and excessive materials into war use under Regulation 13. They point out that special concessions to utilities in the matter of handling charges would bring demands for similar concessions from other inventory owners. Allow enough of these concessions, they argue, and the flow of excess material from the shelves to the market is restricted. Such a development could do serious damage to the war effort.

Industrial buyers, it is further argued, often will take idle or excess material rather than place mill orders because they can get a slight "break on the price." The elimination of this "break" would drive many such buyers out of the market for idle and excess inventories. This possibility is particularly important under the Controlled Materials Plan, which insures delivery of mill materials to fabricators.

There probably is a mutually acceptable answer to the impasse, but no one has yet found it.

NEWS OF THE WEEK

Big Manpower Drain in 1943, N.E.M.A. Told

Essential industry will lose as many men this year as total already taken, Brig.-Gen. Rose tells spring meeting conferees — Adam, Brown and King honored as industry pioneers

"Essential industry will lose just about as many men to the armed forces during 1943 as they have hitherto lost altogether," Brig. Gen. William C. Rose, chief, executive service, War Manpower Commission, told members of the electrical industry at the spring meeting of the National Electrical Manufacturers Association in Chicago, last week.

Manning Table Explained

General Rose flatly asserted that the manpower today is "scarce" and that demands already approximate the total national supply. "This year we must add at least two million more people to our working force and four million to the armed forces. Most of the men for the armed forces must be drawn from the labor market," General Rose pointed out. "We cannot prevent this loss," he cautioned, "but we should plan for replacement."

The Manning Table Plan and its adjunct, the replacement schedule, according to General Rose, is a tool devised by the WMC to assist war industries and essential services such as utilities and railroads to evaluate their manpower problems and evolve a method of handling selective service problems that arise.

In brief, General Rose explained, the Manning Table is an inventory of jobs and personnel necessary for operation of a plant or activity. The replacement summary and replacement list are adjuncts to it. The replacement summary lists jobs within each plant showing for each the total number of workers and an analysis of the availability of the male workers for services in the armed forces. The replacement list lists individuals who are to be released to the armed forces and the month or period they are scheduled for release. Time of release is governed by ability of the employer to obtain replacements through hiring, transferring or upgrading. The order of release is generally determined by their selective service status.

If industries do not wish to prepare a Manning Table they continue to operate exactly as in the past and will receive the same consideration of selective service problems as in the past, it was stated. Interested industries should apply to WMC regional or area directors for permission to make the table. These agencies will approve or disapprove the application. Tables are drafted by industry and transmitted to regional or area offices for review and acceptance, it was explained.

Industry Veterans Honored

Feature of the NEMA spring luncheon was the presentation of three 50-year Gold Certificates to pioneers who have been associated with the electrical industry for the past half century. Certificates were presented to: Fred B. Adam, president Frank Adam Electric Co., St. Louis, Mo.; Charles Edward Brown, executive vice-president the Okonite Co., Chicago, and Charles K. King, president Ohio Brass Co., Mansfield, Ohio.

Fred B. Adam entered the electrical industry in 1891 as secretary of that company, which had just been organized. In 1901 the company purchased the electric light and power switchboard department of the Emerson Electric Manufacturing Co. and placed it under Mr. Adam's direction. As a result of knowledge gained in this field, Mr. Adam developed and patented many improved designs of switches, circuit breakers, panelboards and switchboards. He was the first to develop sheet steel inclosures for these products. In the fall of 1922, on the death of his father, Mr. Adam became

INDUSTRY PIONEERS HONORED—Feature of the N.E.M.A. spring luncheon meeting was the presentation of three 50-year gold certificates to industry pioneers. Above, left to right, Charles K. King, president Ohio Brass; Charles Edward Brown, executive vice-president Okonite, and Fred B. Adam, president Frank Adam Electric Co.

president of the company, the position he now holds.

Charles Edward Brown began his business career with Marshall Field & Co. in 1884, remaining there for five years when he became associated with McKinlock Bros., organizers of the Central Electric Co. He was made secretary of the company and remained in the electrical supply business until 1925 as vice-president and director. In that year he joined the Okonite Co. as executive vice-president and director, having been a director for several years prior to that time. Mr. Brown has remained in this capacity to the present.

C. K. King began his career in the electrical industry in 1890 when he joined the Northwest Thomson Houston Co., working on the construction of electric railways. Three years later he became affiliated with the Ohio Brass Co. in the electric railway department. In 1895 Mr. King became a director of the company and was made secretary the following year. He was elected vice-president in 1905 and vice-president and general manager in 1927. Mr. King became president of Ohio Brass Co. in 1928 and has held that position continuously since that time.

•

REA Allots $679,000 to Six Systems

The Rural Electrification Administration recently announced allotments totaling $679,000 to six systems, to cover acquisition and rehabilitation of existing properties and, in one case, line extension. These new allotments bring the total to $462,445,465, of which $3,724,550 represents operations during the current fiscal year.

In announcing the allotments REA Administrator Harry Slattery said that no new construction will be undertaken except in accordance with authorization or regulation of WPB.

Details are as follows:

COLORADO—Holy Cross Electric Assn., Inc., Basalt, $175,999 to acquire and complete 121 miles of line, 539 members.

KANSAS — Norton-Decatur Co-operative Electric Co., Inc., Norton, $10,000 to acquire and complete 10 miles of line, 62 members.

MINNESOTA—Wright-Hennepin Co-operative Electric Assn., Maple Lake, $50,000 to complete work orders having WPB authorization.

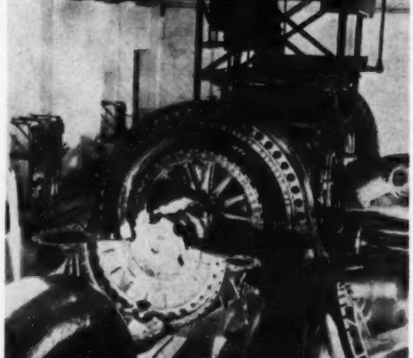
MISSOURI—Laclede Electric Co-operative, Lebanon, $216,000 to acquire and complete 144 miles of line, 940 members.

VIRGINIA—Northern Piedmont Electric Co-operative, Culpeper, $45,000 for acquisition and rehabilitation of hydro plant and 10 miles of line.

WASHINGTON—Public Utility District No. 1 of Clallam County, Port Angeles, $120,000 for purchase and rehabilitation of generating facilities.

NEWS BRIEFS

TWO OBSOLETE GENERATING UNITS at the Borel hydro plant of the Southern California Edison Co. recently went into war production as greatly needed scrap metal. The two units, each of which had a rated capacity of 2,000 kva., began operation on December 31, 1904, when the plant was built. In 1931 they were replaced by one unit



having an operating capacity of 5,700 kw. This unit, with two existing units kept in service, makes the present operating capacity of the plant 10,200 kw.

MEMBERS OF THE Electric Club of Washington, at a recent bond rally, voted to purchase $6,800,000 in war bonds for the purchase of 19 Boeing bombers. The goal of the club has been set for 25 bombers, according to R. D. Horning, manager of the Seattle Electrical Contractors' Association, and Louis Benedetti, president of the Industrial Electric Co., who proposed the plan to the club.

MEN AND WOMEN not physically qualified for military duty will be given free training for Army Signal Corps work in a new University of Chicago course in advanced radio, electronics and micro-waves beginning May 3. Graduates of the 20-week course will be given Signal Corps jobs at salaries ranging from $1,800 to $2,000.

SCORES OF POLES of the Puget Sound Power & Light Co. toppled in a terrific windstorm last week, interrupting power service in many sections. The company was forced to appeal to the police for men to guard live wires and poles until trouble shooters could reach the scene.

SHORTAGES OF CRITICAL MATERIALS have led the Connecticut Public Utilities Commission to suspend its recent order adopting a proposed uniform power factor penalty clause for inclusion in rate schedules of all electric utility companies in the state. Extreme difficulties in obtaining capacitors by either users of electric service or suppliers of it are cited as making the order unenforceable. Until further notice, the utilities are enjoined to continue in force penalties already existing for low power-factor in their rate schedules and to maintain monthly records of maximum reactive power averaged over one hour, when supplied to their systems or subdivisions, the reactive power sold and revenues thus derived.

FOR THE BENEFIT of war workers and others who wish to pay their light bills before or after office hours, Alabama Power has arranged a night depository outside its Mobile office. Depository envelopes are kept in a box near by, so that the customer may take one, place his money or check therein with bill, and drop in the box.

A GRAPHIC STORY of turbine theory and principles is told in the new 16-mm. sound movie, produced by Allis-Chalmers, and designed to train new war workers in power plants. Simplified, animated drawings bring to life the mechanics of the steam turbine on the screen. Prints of the film are available for loan or purchase.

A RECENT MEETING of the Montclair (N. J.) Society of Engineers was distinguished by the presence of the presidents of three of the four "founder societies." Present were Harold S. Osborne, A.I.E.E.; Harold V. Coes, A.S.M.E., and C. H. Mathewson, A.I.M. & M. Also scheduled to be present was Ezra B. Whitman, president of A.S.C.E., but, at the last minute, he was unable to attend, according to Morris D. Hooven, president of the Montclair group.

CONSTRUCTION OF A SUBMERGED WEIR in the Niagara River above the Canadian and American Falls has been completed recently, increasing power production and preserving the beauty of the falls. The weir required some 27,000 tons of stone for the 1,400-ft. long project.

THE BUREAU OF MINES will shortly publish an information circular on "The Storage of Coal," by J. F. Barkley, chief, Division of Solid Fuels Utilization for War, according to an announcement by the Council of Electric Operating Companies. The circular revises and extends previous technical literature which the bureau has issued on the subject.

Charge OWU Is Run by "Power Trust" Men

Representatives see discrimination against Congressionally-authorized power projects in letter urging necessity for investigation of WPB power program — Shipshaw financing cited

Charges that "our war program seems to be dictated by power trust men (in the Office of War Utilities) who seem to be discriminating against Congressionally authorized power projects" were made by three Representatives in a letter to Chairman Adolph J. Sabath, Illinois Democrat, of the House rules committee.

Puerto Rico Unit Cited

The letter was signed by Reps. John M. Coffee, Washington, and Jerry Voorhis, California, both Democrats, and William A. Pittenger, Minnesota Republican. It was filed with the rules committee at Sabath's request for additional information on the necessity for a Congressional investigation of the WPB power program, as proposed by Rep. Coffee (ELECTRICAL WORLD, April 3 and 24, 1943, pages 71 and 15 respectively).

The three Representatives charged that OWU was guilty of "bad planning, if nothing more," when a 7,500-kw. steam generator was returned from Puerto Rico by Federal Works Administrator Philip B. Fleming as not needed there (ELECTRICAL WORLD, April 10, 1943, page 4). At the same time, it was alleged, a comparable unit was "vitally needed" at a military installation on the Atlantic Coast because the unit ordered for that post had been sent abroad under Lend Lease.

See War Effort Delay

In an earlier letter to the rules committee in support of his investigation resolution Rep. Coffee charged discrimination by OWU against Congressionally authorized projects in favor of private projects with the comment:

"The war effort has been impeded by delay and poor allocation of materials. Certain companies seem to be particularly well-represented in the Power Division (OWU). It should be seen whether these companies are being favored over other companies."

Both letters reiterated a need for investigation into the financing of the Shipshaw power development in Canada and into the diversion of generating capacity from U. S. power developments to those of other nations, particularly to Shipshaw.

Two 40,000-Hp. Units in Operation in N.C.

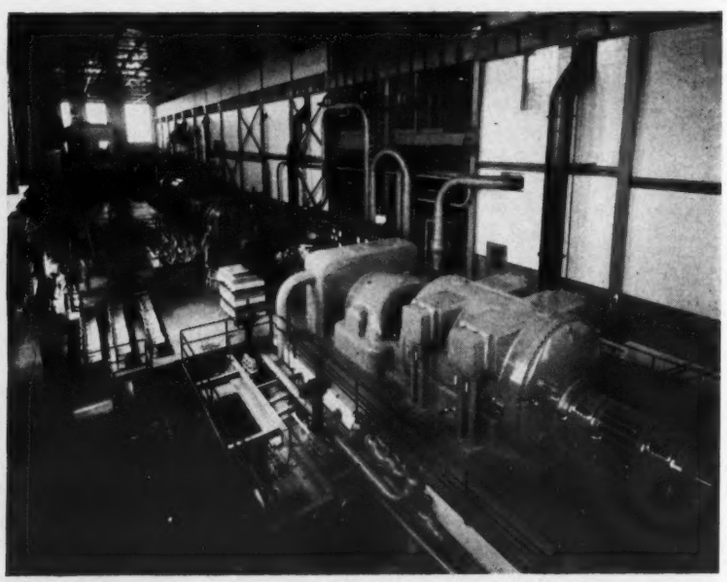
Triple production at Carolina P. & L.'s Cape Fear plant

"The manner in which industry has responded to the challenge of war demonstrates once again that industry under private management, with reasonable government supervision, is not only in keeping with the American way of life but the most productive," Governor Broughton of North Carolina declared recently at the formal opening of two new 40,000-hp. units which tripled the production of the Carolina Power & Light Co.'s steam-driven generating plant on the Cape Fear River.

On May 8, 1941, the Governor broke ground for the additional units and had returned for the ceremony dedicating them to civilian and military use in the area served by the company. Addition of the 80,000-hp. additional brings company's total facilities to 532,000 hp.

Original Capacity 5,000 HP

At the dedication Louis V. Sutton, president and general manager of the company, revealed that when the utility was first chartered in 1908 it had a total generating capacity of 5,000 hp. "The original part of this Cape Fear plant was built around 1923 with two generating units having a capacity of 40,000 hp.," he said. "The addition of the two new units will bring the capacity of the plant to 120,000 hp."



FORMAL OPENING—Governor Broughton of North Carolina, right, opens the valve which formally places in service the second 40,000-hp. unit of Carolina Power & Light Co.'s Cape Fear River generating plant. Left to right: L. V. Sutton, president and general manager of the company; W. C. Mathis, superintendent of the Cape Fear plant; Josephus Daniels, ex-Secretary of the Navy and Ambassador to Mexico; Governor Broughton. At right, interior view of the plant showing in the foreground the two new units of 40,000 hp. each. By these additions the capacity of the plant was raised to 120,000 hp.

River Authorities' Power Ambition Scored in Texas

Flood control, soil erosion and irrigation incidental to generation, distribution and transmission of power, committee investigating GBRA and LCRA activities in San Antonio reports

Charges that flood control, soil and forest conservation, irrigation and other purposes for which river authorities were created have become mere incidents to the generation, distribution and sale of power and may eventually present a greater problem than "the holding company evils with which we have had to contend in the past" were made in the first 1,000-page report of the special House investigating committee of the Texas Legislature recently. The preliminary report was issued after two months of investigation of the activities of the Guadaloupe-Blanco River Authority and the Lower Colorado River Authority in connection with their participation in the sale of the San Antonio Public Service Co. and the subsequent lease of that utility's Comal generating plant to LCRA. The committee's report is now the basis for urging passage of legislation curbing the powers of river authorities (ELECTRICAL WORLD, April 3, page 69; April 17, page 82; April 24, page 6).

San Antonio Purchase Cited

"It is apparent," the report said, "that those in control of these authorities have been far more interested in setting up under their guidance and coordinating a gigantic water and steam generating and transmission line business, and have sought to bring this about by acquiring and taking over existing private utilities and generating plants." Specifically mentioned as responsible for collaborating on designs and policies of the authorities were Ed Cape, director, general manager and general counsel of GBRA, and A. J. Wirtz, "dominant voice in control" of LCRA and agent and adviser to GBRA.

Recounting the familiar story that GBRA, a state agency without any appreciable assets, began negotiating for the purchase of San Antonio Public Service; prepared a bond issue for the purpose which was turned down by the Attorney-General, and then filed suits against the city of San Antonio to restrain it from buying the properties, the report said an agreement was entered into by San Antonio, GBRA and LCRA whereby the suits and countersuits were dismissed and the city permitted to buy the utility for about $34,000,000. Condition of the sale was that GBRA be given a 30-year lease on the utility's Comal generating plant, with option to buy for about $3,000,000, the city to contract to take a minimum amount of power from the lessee, exceeding the amount of the $262,000 annual rental. Transfer of this lease by GBRA to LCRA, for which the latter agreed to pay $250,000 a year for 30 years, plus half the net earnings of the plant, was also recounted.

"It is clear," the report said, "that GBRA acquired the plant, not for use in connection with the manufacture by it of hydro-electric power, but for the purpose of making a profit on the assignment of the lease to LCRA." For no service performed, in other words, the GBRA stands to profit to the extent of from $7,500,000 to $25,000,000 through payments from LCRA, the report stated.

Detailing the large sums of money which passed hands in connection with the transfer of the properties, all of which admittedly was returned by the recipients when the city of San Antonio entered suit to annul the contracts, the report declared that the agreements had been brought about by "methods which should be and would be loudly condemned if resorted to by private enterprise." The report recommended that legislation be enacted to make it unlawful for authorities to pay fees and commissions in the sale and acquisition of utility properties.

Further recommended in the report was that the Attorney-General be made the supervisor of all legal work for the authorities; that laws be enacted to require authorities to compensate for state, county and local taxes lost which would have normally been paid by the public utilities. In San Antonio, the report pointed out, this payment amounted to some $500,000 in ad valorum taxes, of which about $150,000 was state and county.

Decry Steam Plant Acquisitions

"A very important question that has come out of our investigation is the extent to which these river authorities may engage in the business of generating electric power by steam plants," the report said. "The constitutional provision authorizing the creation of these authorities seems to limit the generation of power to hydro-electric plants in connection with dams operated by the authorities. If they have the authority . . . to go into the steam plant generating field generally, there is nothing in the law at the present to prevent the LCRA, or any other river authority, from extending its operations to cover the entire southwest. The idea of river authorities bidding against each other for utility properties in a race to extend their electric power operations is easily conceivable. It is considered the Legislature should clarify this situation . . ."

Paid Brokers $509,250

Pointing out that the city of San Antonio, in connection with the purchase of the San Antonio Public Service Co., had, in fact, paid brokers some $509,250, of which the brokers paid about $60,000 in attorney fees, the report emphasized the evils which may flow from a policy of allowing agents, promoters and others to make huge sums of money out of the sale or acquisition of large utility projects.

As a snapper, the committee announced that its investigation had incurred or expended the sum of $10.20 in its investigation.

•

Radio Parts, Tubes Turn-in Ordered

Requirement that unusable radio parts and tubes be turned in by purchasers of replacements has become official with the issuance of WPB's order L-265 (ELECTRICAL WORLD, March 13, 1943, page 15).

The order requires that old parts be exchanged for new ones in all cases except where the return would be impractical. No priority rating is required of civilians seeking replacement parts.

Principal exception to the turn-in requirement is in the case of mail order purchases, for which purchasers need not return unusable parts but must certify that the part is for repair of domestic equipment.

Dealers are not required to hand in their accumulated turn-ins when replenishing their stock, but will purchase replacements on certifications that their sales were for repair use by civilians. Accumulated parts must be turned in for salvage at least every 60 days. Records of sales and purchasers must be kept.

The designation "Victory" for the standardized parts and tubes now being produced has been dropped by WPB.

Farm Program Subject of Utility Conference

Commonwealth & Southern Corp. sponsors two-day meeting on "Planning for Greater Food Production" — Role of rural electrification in augmenting nation's food supply lauded by speakers

American farmers are equipped for a nearly normal food production in 1943 provided a reasonable farm labor supply is made available, but they are not equipped for maximum production with minimum labor, E. G. McKibben, consultant for the Farm Machinery Division, Equipment Bureau, WPB, told a two-day food conference, sponsored by the Commonwealth & Southern Corp., last week.

Justin Whiting Presides

Justin R. Whiting, president of the utility holding company, opened the meeting and reported that the operating companies in the system had in operation in 1942 some 40,000 miles of farm lines, serving approximately 158,000 farms, representing an investment of about $60,000,000. He introduced the first speaker, G. Edward Pendray, assistant to the president of the Westinghouse Electric & Manufacturing Co., who recounted the rapid strides made in the electrification of America's farms. After the war, Mr. Pendray said, electricity would play a major part in easing the tasks of the farmer and making his work more profitable. In 1922, Mr. Pendray pointed out, only 175,000 of the nation's farms were served by electricity. By 1935 the number had grown to 800,000 and, at the end of 1942, had mounted to 2,240,000, or 38 percent of all the farms in the United States. Just before Pearl Harbor, he said, farms were being electrified at the rate of 200,000 a year.

Another speaker on the program, G. A. Reitz, in charge of General Electric's Farm Electrification Section, declared that the important part electricity is playing in food production and the larger part it can play, if given its just place in the farm equipment picture, apparently is not fully appreciated.

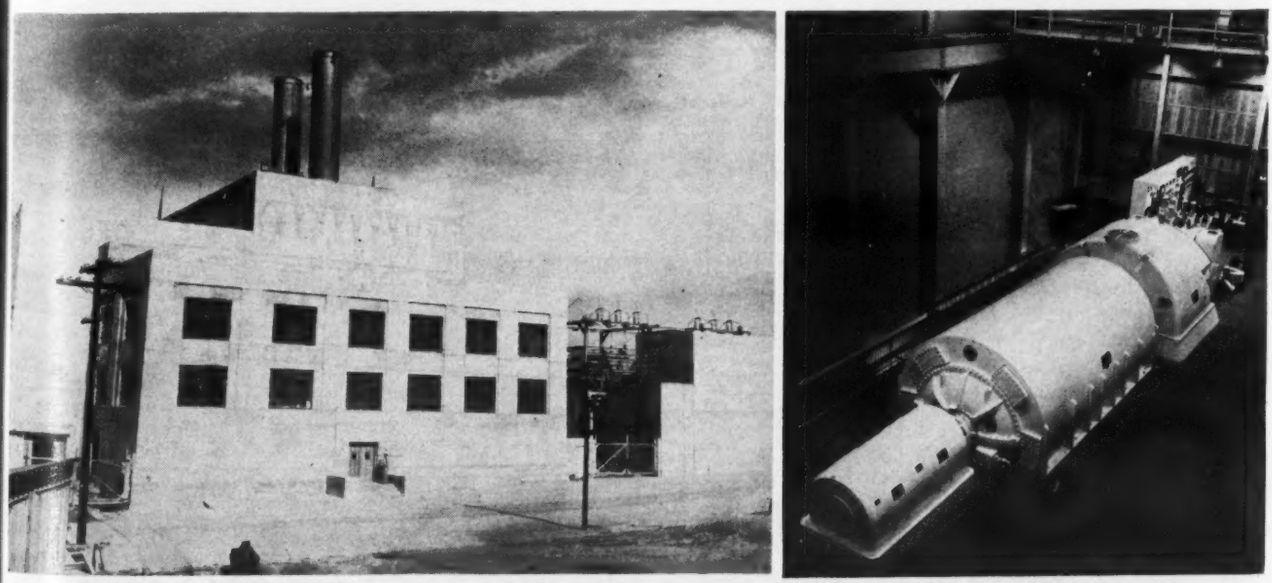
"The scarcity of new equipment immediately focusses our attention on an important job—that of keeping equipment farmers have operating," he said. "The second is to help farmers make their present equipment do still more jobs. The third is to get priorities for new equipment they honestly need, and fourth, we must sell the important place electrical equipment must be allowed to play if the food production goals are to be reached, handicapped as we are by the shortage of farm workers."

The Maintenance Problem

His contribution was echoed by A. P. Yerkes, director of farm practice for International Harvester Co., who said that more than 50,000,000 pieces of farm equipment on the more than 6,000,000 American farms must be kept in working order if our food production program is to proceed without serious interference.

"This will require the manufacture, distribution and installation of probably 300,000,000 repair parts of more than a million different kinds," he said. Farm machinery repair will be greater than normal this season, he added, with 67 percent more repair parts distributed than in 1940, but farmers will have to travel farther to get them because there are fewer repair dealers than the 30,000 before the war.

Other speakers on the Commonwealth & Southern program, which was attended by some 200 people from the operating companies of the system, were L. F. Livingston of E. I. du Pont de Nemours & Co., Wheeler McMillen, president of the National Farm Chemurgic Council, and G. R. Roelfs of the Central Illinois Light Co. Discussions on a varied assortment of subjects concerning electricity and the farm, manpower, rate schedules, equipment maintenance and other topics made up the remainder of the program.



SAN DIEGO'S SILVER GATE—The new Silver Gate generating station of San Diego Gas & Electric Co. has been completed and the first 35,000-kw. unit (G.E.) placed in operation. The new $4,000,000 plant is windowless (except for the administration building) and operates on either natural gas or fuel oil. Ultimate capacity will be increased by the addition of three 50,000-kw. units as needed. The gleaming white turbine and control panel, together with dark red tile floors, make this one of the handsomest of modern power plants. The 3,600-r.p.m. turbine is fed by two Babcock & Wilcox boilers. Steam is supplied at 850 psi. with a temperature of 900 F. Rated at 35,000 kw., the unit is capable of delivering 44,000, according to company engineers

River Authorities' Power Ambition Scored in Texas

Flood control, soil erosion and irrigation incidental to generation, distribution and transmission of power, committee investigating GBRA and LCRA activities in San Antonio reports

Charges that flood control, soil and forest conservation, irrigation and other purposes for which river authorities were created have become mere incidents to the generation, distribution and sale of power and may eventually present a greater problem than "the holding company evils with which we have had to contend in the past" were made in the first 1,000-page report of the special House investigating committee of the Texas Legislature recently. The preliminary report was issued after two months of investigation of the activities of the Guadaloupe-Blanco River Authority and the Lower Colorado River Authority in connection with their participation in the sale of the San Antonio Public Service Co. and the subsequent lease of that utility's Comal generating plant to LCRA. The committee's report is now the basis for urging passage of legislation curbing the powers of river authorities (ELECTRICAL WORLD, April 3, page 69; April 17, page 82; April 24, page 6).

San Antonio Purchase Cited

"It is apparent," the report said, "that those in control of these authorities have been far more interested in setting up under their guidance and coordinating a gigantic water and steam generating and transmission line business, and have sought to bring this about by acquiring and taking over existing private utilities and generating plants." Specifically mentioned as responsible for collaborating on designs and policies of the authorities were Ed Cape, director, general manager and general counsel of GBRA, and A. J. Wirtz, "dominant voice in control" of LCRA and agent and adviser to GBRA.

Recounting the familiar story that GBRA, a state agency without any appreciable assets, began negotiating for the purchase of San Antonio Public Service; prepared a bond issue for the purpose which was turned down by the Attorney-General, and then filed suits against the city of San Antonio to restrain it from buying the properties, the report said an agreement was entered into by San Antonio, GBRA and LCRA whereby the suits and countersuits were dismissed and the city permitted to buy the utility for about $34,000,000. Condition of the sale was that GBRA be given a 30-year lease on the utility's Comal generating plant, with option to buy for about $3,000,000, the city to contract to take a minimum amount of power from the lessee, exceeding the amount of the $262,000 annual rental. Transfer of this lease by GBRA to LCRA, for which the latter agreed to pay $250,000 a year for 30 years, plus half the net earnings of the plant, was also recounted.

"It is clear," the report said, "that GBRA acquired the plant, not for use in connection with the manufacture by it of hydro-electric power, but for the purpose of making a profit on the assignment of the lease to LCRA." For no service performed, in other words, the GBRA stands to profit to the extent of from $7,500,000 to $25,000,000 through payments from LCRA, the report stated.

Detailing the large sums of money which passed hands in connection with the transfer of the properties, all of which admittedly was returned by the recipients when the city of San Antonio entered suit to annul the contracts, the report declared that the agreements had been brought about by "methods which should be and would be loudly condemned if resorted to by private enterprise." The report recommended that legislation be enacted to make it unlawful for authorities to pay fees and commissions in the sale and acquisition of utility properties.

Further recommended in the report was that the Attorney-General be made the supervisor of all legal work for the authorities; that laws be enacted to require authorities to compensate for state, county and local taxes lost which would have normally been paid by the public utilities. In San Antonio, the report pointed out, this payment amounted to some $500,000 in ad valorum taxes, of which about $150,000 was state and county.

Decry Steam Plant Acquisitions

"A very important question that has come out of our investigation is the extent to which these river authorities may engage in the business of generating electric power by steam plants," the report said. "The constitutional provision authorizing the creation of these authorities seems to limit the generation of power to hydro-electric plants in connection with dams operated by the authorities. If they have the authority . . . to go into the steam plant generating field generally, there is nothing in the law at the present to prevent the LCRA, or any other river authority, from extending its operations to cover the entire southwest. The idea of river authorities bidding against each other for utility properties in a race to extend their electric power operations is easily conceivable. It is considered the Legislature should clarify this situation . . ."

Paid Brokers $509,250

Pointing out that the city of San Antonio, in connection with the purchase of the San Antonio Public Service Co., had, in fact, paid brokers some $509,250, of which the brokers paid about $60,000 in attorney fees, the report emphasized the evils which may flow from a policy of allowing agents, promoters and others to make huge sums of money out of the sale or acquisition of large utility projects.

As a snapper, the committee announced that its investigation had incurred or expended the sum of $10.20 in its investigation.

•

Radio Parts, Tubes Turn-in Ordered

Requirement that unusable radio parts and tubes be turned in by purchasers of replacements has become official with the issuance of WPB's order L-265 (ELECTRICAL WORLD, March 13, 1943, page 15).

The order requires that old parts be exchanged for new ones in all cases except where the return would be impractical. No priority rating is required of civilians seeking replacement parts.

Principal exception to the turn-in requirement is in the case of mail order purchases, for which purchasers need not return unusable parts but must certify that the part is for repair of domestic equipment.

Dealers are not required to hand in their accumulated turn-ins when replenishing their stock, but will purchase replacements on certifications that their sales were for repair use by civilians. Accumulated parts must be turned in for salvage at least every 60 days. Records of sales and purchasers must be kept.

The designation "Victory" for the standardized parts and tubes now being produced has been dropped by WPB.

Farm Program Subject of Utility Conference

Commonwealth & Southern Corp. sponsors two-day meeting on "Planning for Greater Food Production" — Role of rural electrification in augmenting nation's food supply lauded by speakers

American farmers are equipped for a nearly normal food production in 1943 provided a reasonable farm labor supply is made available, but they are not equipped for maximum production with minimum labor, E. G. McKibben, consultant for the Farm Machinery Division, Equipment Bureau, WPB, told a two-day food conference, sponsored by the Commonwealth & Southern Corp., last week.

Justin Whiting Presides

Justin R. Whiting, president of the utility holding company, opened the meeting and reported that the operating companies in the system had in operation in 1942 some 40,000 miles of farm lines, serving approximately 158,000 farms, representing an investment of about $60,000,000. He introduced the first speaker, G. Edward Pendray, assistant to the president of the Westinghouse Electric & Manufacturing Co., who recounted the rapid strides made in the electrification of America's farms. After the war, Mr. Pendray said, electricity would play a major part in easing the tasks of the farmer and making his work more profitable. In 1922, Mr. Pendray pointed out, only 175,000 of the nation's farms were served by electricity. By 1935 the number had grown to 800,000 and, at the end of 1942, had mounted to 2,240,000, or 38 percent of all the farms in the United States. Just before Pearl Harbor, he said, farms were being electrified at the rate of 200,000 a year.

Another speaker on the program, G. A. Reitz, in charge of General Electric's Farm Electrification Section, declared that the important part electricity is playing in food production and the larger part it can play, if given its just place in the farm equipment picture, apparently is not fully appreciated.

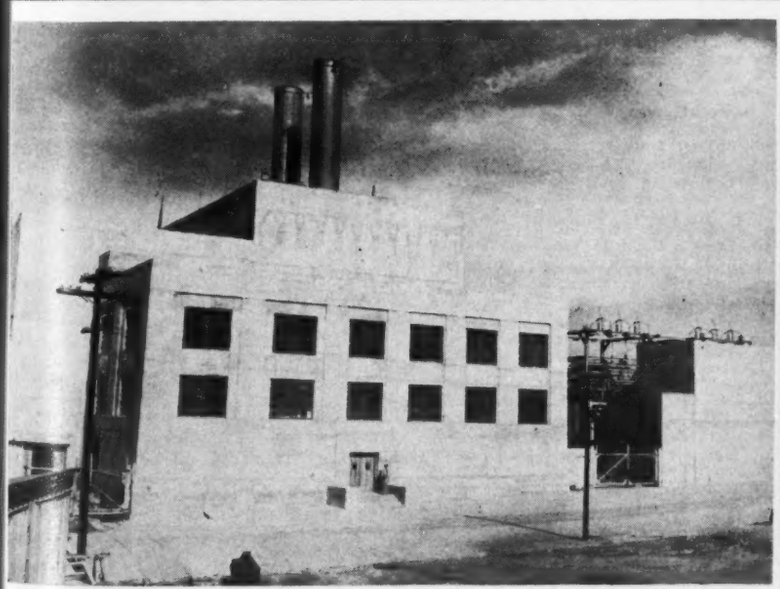
"The scarcity of new equipment immediately focusses our attention on an important job—that of keeping equipment farmers have operating," he said. "The second is to help farmers make their present equipment do still more jobs. The third is to get priorities for new equipment they honestly need, and fourth, we must sell the important place electrical equipment must be allowed to play if the food production goals are to be reached, handicapped as we are by the shortage of farm workers."

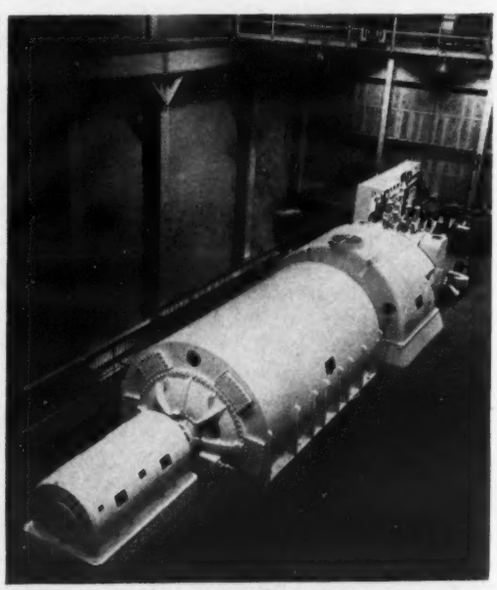
The Maintenance Problem

His contribution was echoed by A. P. Yerkes, director of farm practice for International Harvester Co., who said that more than 50,000,000 pieces of farm equipment on the more than 6,000,000 American farms must be kept in working order if our food production program is to proceed without serious interference.

"This will require the manufacture, distribution and installation of probably 300,000,000 repair parts of more than a million different kinds," he said. Farm machinery repair will be greater than normal this season, he added, with 67 percent more repair parts distributed than in 1940, but farmers will have to travel farther to get them because there are fewer repair dealers than the 30,000 before the war.

Other speakers on the Commonwealth & Southern program, which was attended by some 200 people from the operating companies of the system, were L. F. Livingston of E. I. du Pont de Nemours & Co., Wheeler McMillen, president of the National Farm Chemurgic Council, and G. R. Roelfs of the Central Illinois Light Co. Discussions on a varied assortment of subjects concerning electricity and the farm, manpower, rate schedules, equipment maintenance and other topics made up the remainder of the program.





SAN DIEGO'S SILVER GATE—The new Silver Gate generating station of San Diego Gas & Electric Co. has been completed and the first 35,000-kw. unit (G.E.) placed in operation. The new $4,000,000 plant is windowless (except for the administration building) and operates on either natural gas or fuel oil. Ultimate capacity will be increased by the addition of three 50,000-kw. units as needed. The gleaming white turbine and control panel, together with dark red tile floors, make this one of the handsomest of modern power plants. The 3,600-r.p.m. turbine is fed by two Babcock & Wilcox boilers. Steam is supplied at 850 psi. with a temperature of 900 F. Rated at 35,000 kw., the unit is capable of delivering 44,000, according to company engineers

House Allots REA $22,258,000

$20,000,000 for co-op loans included

After considerable parliamentary maneuvering, the House recently approved appropriations totaling $22,258,000 for the Rural Electrification Administration for the fiscal year of 1944.

RFC Credit Out

Only change in the measure reported by the House appropriations committee's subcommittee on Agriculture (ELECTRICAL WORLD, April 17, 1943, page 86) was that the $20,000,000 provided for REA loans to co-operatives was made a direct appropriation rather than by credit upon the Reconstruction Finance Corporation.

The subcommittee reversed its customary procedure of making direct appropriations for loans and provided for credit with RFC as a guard against possibility that a large portion of the appropriation would remain unexpended. Curtailment of construction by WPB orders allowed REA to spend only approximately $3,000,000 of its $30,000,000 appropriation for fiscal 1943.

The new procedure of the fiscal 1944 bill was ruled out on a point of order, whereupon an amendment was introduced to give REA $20,000,000 for loans to co-ops by direct appropriation. The amendment was approved despite objection by the subcommittee chairman, who argued that the Senate would rectify the matter and allow REA its loan funds on a credit basis.

Lost in the parliamentary shuffle was an amendment by Rep. Lyle H. Boren, Oklahoma Democrat, which would specifically have denied REA the privilege of using any part of the $20,000,000 to purchase existing systems.

An attempt by Rep. John E. Rankin, Mississippi Democrat, to augment by $219,000 the $2,258,000 appropriation for administrative expenses also was a victim of the parliamentary tangle.

•

Snohomish PUD Denied New Trial on Valuation

The Snohomish (Wash.) PUD has been denied a motion for a new trial in a suit to establish value of property operated by the Puget Sound Power & Light Co. in the district. Federal Judge John C. Bowen, who presided over the seven-week trial, in which the PUD was ordered to pay the power company $9,500,000 if it takes over the latter's properties, rejected the company's motion for new trial.

Although this is the fourth county district to go to trial, it is a matter of record that none, so far, has acquired any of the company's properties under one of these awards. The first trial was that of Whatcom County in 1940, and a year ago the tri-county trial was held involving Thurston, Lewis and Cowlitz counties. After the jury verdicts and the entries of judgments, the districts hold elections to decide whether too accept or reject the judgments.

•

MEETINGS

Air Conditioning and Refrigerating Machinery Association—Annual meeting, Waldorf-Astoria Hotel, New York, N. Y., May 14. M. J. Stewart, secretary, Southern Bldg., Washington, D. C.

Pennsylvania Electric Association—Meter committee, Roosevelt Hotel, Pittsburgh, Pa., May 21. S. J. DeLuca, chairman, Chester County Light and Power Co., Wilmington, Del.

Illuminating Engineering Society — Northeastern regional conference, Shelton Hotel, New York, N. Y., June 11. C. C. Keller, regional vice-president, Holophane Co., 342 Madison Ave., New York, N. Y.

Previously Listed

Pennsylvania Electric Association—Systems operation committee, Hotel Brunswick, Lancaster, Pa., May 6-7; E. W. Middleton, chairman, Pennsylvania Power & Light Co., Hazleton, Pa. Electrical equipment committee, Altoona, Pa., May 20-21; A. N. Shealy, chairman, Pennsylvania Water & Power Co., Baltimore, Md.

Association of Iron and Steel Engineers—Spring conference, William Penn Hotel, Pittsburgh, Pa., May 10. Brent Wiley, managing director, Empire Bldg., Pittsburgh, Pa.

Arkansas Utilities Association — Annual convention, Marion Hotel, Little Rock, Ark., May 10-11. R. E. Ritchie, secretary, P. O. Box 551, Little Rock, Ark.

Edison Electric Institute — Electrical equipment, meter and service, prime movers, and transmission and distribution committees, Edgewater Beach Hotel, Chicago, Ill., May 10-11; accident prevention committee, Edgewater Beach Hotel, Chicago, Ill., May 12-13; annual meeting, Waldorf-Astoria Hotel, New York, N. Y., June 2-4. Col. H. S. Bennion, managing director, 420 Lexington Ave., New York, N. Y.

National Fire Protection Association — Annual meeting, Palmer House, Chicago, Ill., May 10-14. R. S. Moulton, technical secretary, 60 Batterymarch St., Boston, Mass.

National Electrical Wholesalers Association — War conference, Hotel Statler, Buffalo, N. Y., May 24-26. Alfred Byers, secretary, 165 Broadway, New York, N. Y.

Illuminating Engineering Society — Great Lakes regional conference, Rackham Memorial Bldg., Detroit, Mich., June 5. G. R. Baumgartner, regional vice-president, General Electric Co., Nela Park, Cleveland, Ohio.

National District Heating Association — Annual meeting, Hotel Schenley, Pittsburgh, Pa., June 9-10. John F. Collins, Jr., secretary-treasurer, 827 N. Euclid Ave., Pittsburgh, Pa.

American Society of Mechanical Engineers—Semi-annual meeting, Hotel Biltmore, Los Angeles, Calif., June 14-16. Ernest Hartford, executive assistant secretary, 29 West 39th St., New York, N. Y.

Canadian Electrical Association—Annual meeting Seigniory Club, Quebec, June 17-18. B. C. Fairchilds, secretary, 804 Tramways Bldg., Montreal, Que.

Society for Promotion of Engineering Education —Annual meeting, Illinois Institute of Technology, Chicago, Ill., and Northwestern University, Evanston, Ill., June 18-20. F. L. Bishop, secretary, University of Pittsburgh, Pittsburgh, Pa.

American Institute of Electrical Engineers—National technical meeting, Hotel Cleveland, Cleveland, Ohio, June 21-25. H. H. Henline, national secretary, 33 W. 39th St., New York, N. Y.

American Society for Testing Materials—Annual meeting, Pittsburgh, Pa., June 28-July 2. R. E. Hess, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

Deny Sacramento Review on Valuation

The California State Supreme Court recently denied request of the Sacramento Utility District for review of a Railroad Commission decision setting valuation of $11,632,000 on the distribution system of Pacific Gas and Electric Co. within the district's confines. (ELECTRICAL WORLD, March 13, page 9).

In its petition for a writ of review, the district contended that the valuation set was too high and was based upon findings unsupported by testimony and upon erroneous legal grounds. Final valuation was based on earnings in excess of a reasonable rate of return, the district asserted. It also claimed that no evidence was introduced to support either business severance or idle plant damages, which had been allowed.

The court denied the petition without issuing a formal opinion. The district has filed condemnation proceedings in the Sacramento County Superior Court.

•

Suggests Post-war Distribution Control

Post-war plans for the electrical industry based on a scheme of "controlled free enterprise" were proposed to members of the Electric Club of Montreal recently by A. L. Brown, administrator of electrical equipment and supplies, Wartime Prices and Trade Board, who emphasized that he was expressing a "strictly personal opinion."

"If simplification and some degree of standardization have resulted in economies in wartime, as we believe they have, they should be continued in time of reconstruction," Mr. Brown said. "I am not by any means suggesting that competitive business be abolished or even discouraged. I am, however, suggesting that competition should be that of designing, manufacturing and distributing electrical devices and maintaining them in service at the lowest possible cost to the people; not the costly, wasteful competition of gadgets and multiplicity of designs and colors.

Output Up 20 Percent Over '42

The pre-seasonal rise in energy output which began the week previous continued during the week ended April 24. The amount of electrical energy distributed by the light and power industry during that week totaled 3,925,175,000 kw.-hr., compared to 3,916,794,000 kw.-hr. the week previous and 3,882,467,000 kw.-hr. the week ended April 10. Figures for the latest week, according to the Edison Electric Institute, represent an increase of 19.9 percent over the corresponding week in 1942. For the week ended April 17 the gain was 18.4 percent.

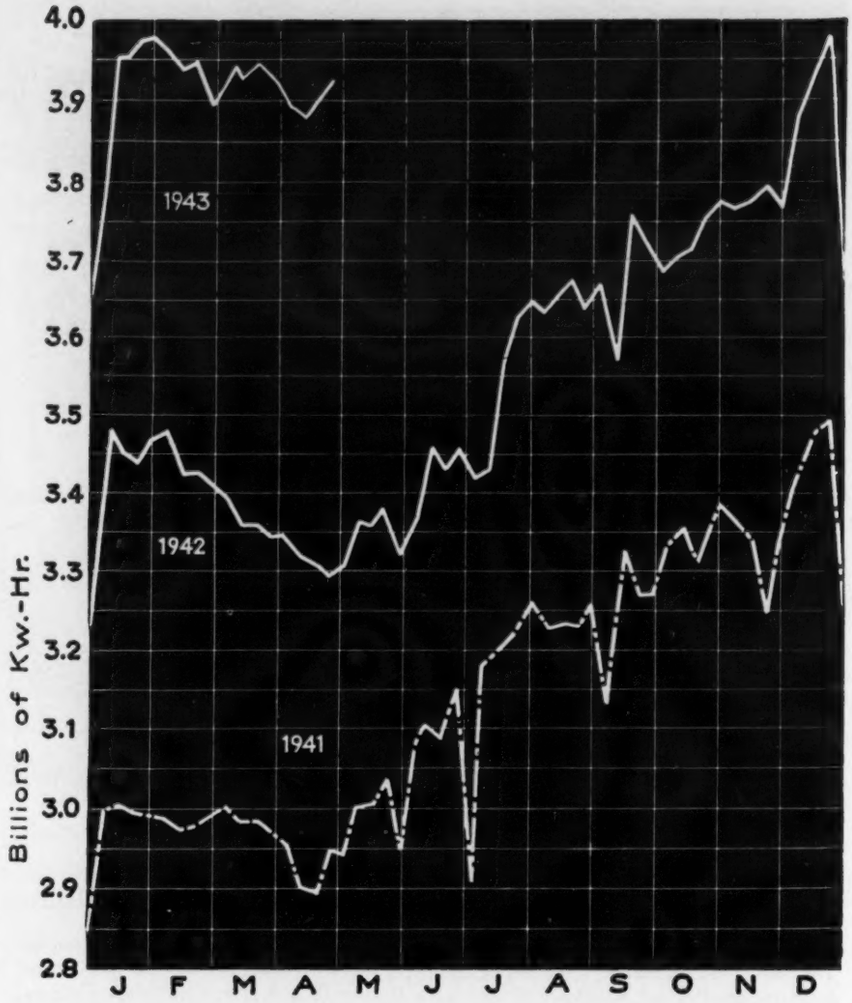
Among the country's seven major geographic areas, the Pacific Coast, by a wide margin, continued to lead in percentage gains over last year's figure for the corresponding period. The latest week's gain was 32.6 percent. In second place still was the Southern states group with a 24.9 percent gain. All the regions except the Rocky Mountain improved their gains from the week previous, in comparison with the 1942 week.

Weekly Output, Millions Kw.-Hr.

1943		1942		1941	
Apr. 24	3,925	Apr. 25	3,273	Apr. 26	2,950
Apr. 17	3,917	Apr. 18	3,708	Apr. 19	2,897
Apr. 10	3,882	Apr. 11	3,321	Apr. 12	2,905
Apr. 3	3,890	Apr. 4	3,348	Apr. 5	2,959
Mar. 27	3,928	Mar. 28	3,345	Mar. 29	2,975
Mar. 20	3,947	Mar. 21	3,357	Mar. 22	2,983
Mar. 13	3,945	Mar. 14	3,357	Mar. 15	2,983
Mar. 6	3,947	Mar. 7	3,392	Mar. 8	3,005
Feb. 27	3,893	Feb. 28	3,410	Mar. 1	2,993
Feb. 20	3,949	Feb. 21	3,423	Feb. 22	2,985

Percent Change from Previous Year

	Week Ending		
	Apr. 24	Apr. 17	Apr. 10
New England	+9.5	+8.9	+9.4
Mid-Atlantic	+16.7	+15.7	+15.3
Central Industrial	+17.3	+17.0	+15.0
West Central	+14.4	+13.8	+12.4
Southern States	+24.9	+20.3	+19.7
Rocky Mountain	+13.9	+14.8	+10.6
Pacific Coast	+32.6	+30.4	+26.9
Total United States	+19.9	+18.4	+16.9



Boiler Going in at Fond du Lac

Installation of a new 605-hp. boiler is in progress at the Fond du Lac power plant of Wisconsin Power & Light Co. The new unit will relieve load on existing boilers and permit operation of existing standby generating equipment at the plant, it is stated. In recent years increases in industrial steam requirements supplied from this plant has taxed the capacity of boilers and left little reserve for operating the generating equipment.

The new boiler unit, together with the existing 300- and 500-hp. units, will increase the boiler capacity at this plant to 1,400 hp. This capacity will be sufficient to supply industrial heating loads and permit operation of the 1,250- and 1,500-kva. emergency stand-by turbogenerators existing at the plant.

Foundations for the new boiler, which will deliver steam at 180 lb. psi., have been completed and the boiler has been received. The unit will be equipped with a three-unit, spreader-type stoker. It will increase steaming capacity of the Fond du Lac plant 75 percent.

•

Pend Oreille Storage Project Being Surveyed

Surveys are under way to lay plans for water storage on Lake Pend Oreille in north Idaho and Flathead Lake in Montana, according to Bonneville Administrator Paul J. Raver, to provide more firm power for both Bonneville and Grand Coulee.

The Pend Oreille project, on the north fork of the Clark River, a tributary of the Columbia, it was said, will have a minimum storage of 3,000,000 acre-feet and will run up to 12,000,000 acre-feet, sufficient to produce an additional 250,000 kw.

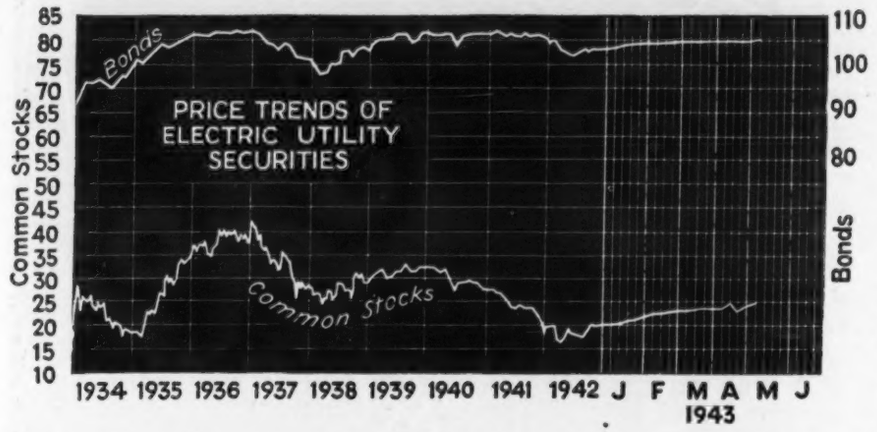
A report from the army engineers making the survey is expected within 60 days, Dr. Raver said.

•

Energy Requirements Up

Electric energy requirements of the principal public utility systems of the country during February totaled 15,765,952,000 kw.-hr., the Federal Power Commission has announced—a gain of 15.6 percent over the same month last year. Corresponding peak demands aggregated 32,408,053 kw., up 9.4 percent over February a year ago. Utility estimates of peak demands for December, 1943, are reported to amount to 37,899,612 kw., representing a decrease of some 44,000 kw. from a similar forecast submitted by the utilities in their January reports.

Utility Stocks and Bonds Continue Gains



The upward trend in prices of electric light and power stocks and bonds continued during the past week. "Electrical World" index advanced to 24.3 from 24.1; last year, 16.8. Bonds went up 0.1 point to 105.3; last year, 101.9

Electric Power Challenges SEC

In a brief filed in the U. S. Circuit Court of Appeals in Boston Electric Power & Light Corp., sub-holding unit in the Electric Bond & Share Co. system, asked the court to set aside a Securities and Exchange Commission order requiring the dissolution of the company, under the "death sentence" provisions of the Holding Company Act. The brief specifically challenges the constitutionality of Section 11 of the act and declares that the "death sentence" is not authorized by the act and is contrary to the intention of Congress in enacting such legislation.

The SEC is seeking to penalize Electric Power & Light, the brief said, because the commission alleges that the Electric Bond & Share system does not conform to the act. "The bombsight of the SEC is obviously focussed on the Bond & Share system; the bomb explodes on the Electric system." The SEC is powerless, the brief said, to force the 24,000 public owners of Electric Power's stock, who are outside the holding company set-up, to surrender their shares in dissolution of the company. The public, other than Bond & Share, owns a total of $514,000,000 of securities of Electric Power & Light and its subsidiaries, the brief continues, and the rights of this large public interest, "which should be paramount, have been ignored by the SEC."

Principal Objections

Listed in the brief were five principal objections to Section 11 of the act: (1) It invades the reserved rights of the states, (2) it contains no standards of guidance, (3) it violates the "due process" clause of the Fifth Amendment, (4) that it penalizes Electric for acts performed before the statute was passed.

•

Illinois Iowa Files to Sell Des Moines

Illinois Iowa Power Co., a subsidiary of North American Co., has filed a petition with the Securities and Exchange Commission to sell its entire common stock interest in Des Moines Electric Light Co. and Iowa Power & Light Co. to Continental Gas & Electric Co. for $10,210,000. The latter company is controlled by United Light & Power Co.

The proposed divestment, the application stated, was in partial compliance with an SEC order of April 14, 1942, requiring North American to divest itself of all its properties except the Union Electric Co. of Missouri.

Utility Reports

	Net Income 1943	1942
†American Gas & Electric and subs.	$11,071,754	$13,645,452
†California Elec. Power and sub.	899,616	757,650
†Central Arizona Lt. & Pwr.	835,589	677,465
*Commonwealth & Southern and subs.	11,871,008	11,963,265
*Consumers Power	7,568,527	9,116,070
*Detroit Edison and subs.	8,235,350	11,615,964
†Mountain States Power	673,691	674,153
†Northwestern Electric	684,665	505,911
*Ohio Edison	3,067,398	3,856,594
†Pacific Power & Light	985,224	700,648
*Public Service of N. J. and subs.	16,457,377	18,867,597

*Twelve months ended March 31.
†Twelve months ended February 28.

FINANCIAL BRIEFS

SEC HAS APPROVED a proposed sale by the American Utilities Service Corp. of the 2,000 common shares of its subsidiary, Northwestern Wisconsin Electric Co., for approximately $264,365 in cash to six individuals. The company plans to use the money to retire $250,000 of its collateral trust 6 percent bonds, series A, due in 1964, in partial compliance with the integration and simplification provisions of the holding company act.

APPLICATION BY THE International Utilities Corp. for an extension of time to December 31, 1943, in order to purchase $276,500 collateral trust bonds, 6½ percent series, from its subsidiary, Dominion Gas & Electric Co., has been approved by the SEC. The commission also granted the corporation's request for authority to purchase an additional $500,000 of these bonds within the same period. Up to last December 31 the corporation had purchased an aggregate of $1,166,000 in Dominion bonds.

GATINEAU POWER CO. HAS APPLIED to Quebec Public Service Board for permission to issue $3,000,000 of 3¾ percent serial debentures, dated June 1, 1943, and maturing $600,000 yearly on June 1, 1944, to 1948 inclusive. The new issue will be for redemption on June 2, 1943, of the $3,000,000 of 5 percent debentures outstanding at 101 and accrued interest.

EMPIRE POWER CORP. and its subsidiary, the United Gas & Electric Corp., have asked the SEC for exemption from the Investment Company Act of 1940 for the delivery of a $2,765,900 promissory note by Empire to United Gas & Electric in return for 24,975 shares of Empire $6 preferred shares as part of a plan to redeem all the 62,828 shares outstanding. The petition stated that Empire Power wished to redeem all of its preferred stock, but has only sufficient funds to make cash payment for the 37,853 shares now in the hands of the public at a call price of $110 per share and accrued dividends up to July 1.

CANADA NORTHERN POWER CORP. reports moderate decline in 1942 operations, due to war conditions. Gross earnings amounted to $4,540,196, compared with $4,994,176 for 1941. After depreciation, bond interest, bad debts and $25,000 for employees' pension fund, net earnings, before income and excess profits taxes, amounted to $1,273,357, compared with $1,288,822 in the previous year. Income and excess taxes were $498,729, being $23,740 lower than a year ago.

WHEN YOU BUY G-E UNIT SUBSTATIONS

The severity of a short circuit depends largely on the capacity of the substation that feeds the circuit, **NOT** on the normal load on the circuit. To assure you of ***adequate*** interrupting capacity for even the most severe short circuits, G-E load-center unit substations are built with ***properly rated*** breakers. These are air circuit breakers which have been co-ordinated—electrically, mechanically, and thermally—with the capacity of the substation and the system.

drawout air circuit breakers are perly rated — can be inspected ckly and safely — and need little ntenance throughout a long life.

FOR DEPENDABLE PERFORMANCE—

G-E air circuit breakers have positive-acting, dual-magnetic, overcurrent trips which provide time-delay protection for overloads (adjustable from 100 to 200 per cent of the breaker rating), and instantaneous protection from short circuits. Silver-to-silver contacts, fast-acting arc quenchers, and generous current-carrying elements assure reliable operation.

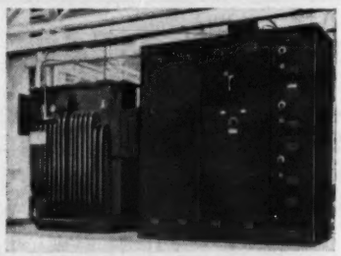
—AND EASY MAINTENANCE

Drawout air circuit breakers, which roll in and out as easily as a file-cabinet drawer, can be inspected, tested, or replaced with another breaker quickly and safely. After a power interruption, a simple turn of the breaker handle quickly restores service. Air circuit breakers in your G-E unit substation assure an important saving in time and labor required for routine inspection and maintenance.

If you need dependable load-center unit substations in a hurry, or simply want more complete information, get in touch with the nearest G-E office, or write to General Electric, Schenectady, N. Y.

FOR D-C, TOO—

RECTIFIER UNIT SUBSTATIONS



Now you can have direct-current power at your load centers by running high-voltage a-c all the way, and converting to d-c with rectifier unit substations located at those centers.

GENERAL ELECTRIC

392-18-5900

HOW DESIGN... CONSTRUCT OPERATE MAINTAIN

Interfacial Tension Reveals Oil Sludging

By G. W. GERELL*
Union Electric Co. of Missouri, St. Louis

In testing transformer insulating oils in service, the major problem is to determine from external observations whether the oil is sludging. If sludging does not exist, and dielectric strength is good, the oil can be presumed adequate. In the past several tests, such as neutralization number, N.P.A. color number and, more recently, Doble power-factor determination, have been used by utility operators to judge whether an oil was sludging. None, however, tell definitely the condition of the oil.

Interfacial tension testing of transformer oils using a DuNouy tensiometer, among several tests suggested by Shell Oil company engineers, has been used by the Union Electric Company during the past 3½ years and found to give an excellent indication of the presence or absence of serious oil sludging. It is a simple, quickly made test and does not require lowering of oil level or internal inspection of equipment.

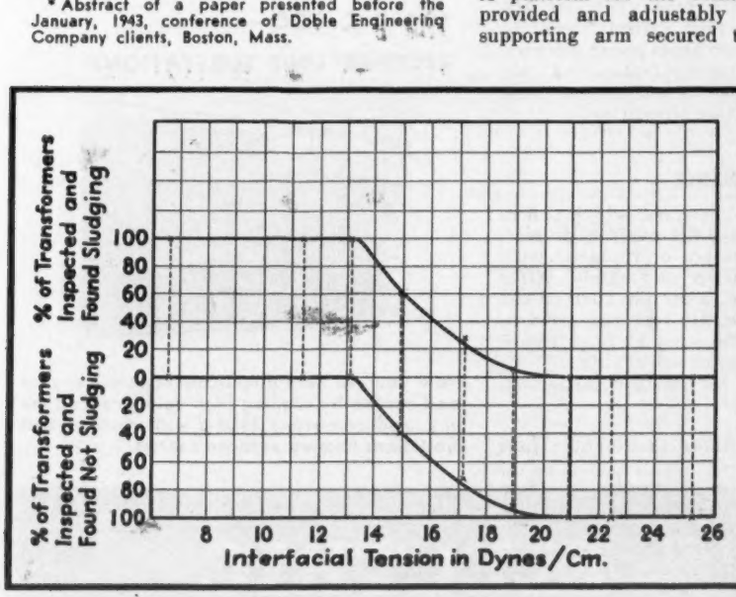
Interfacial tension of an oil, against water, is a measure of hydrophilic groups in an oil and can be rapidly measured with a DuNouy tensiometer. It is an index of molecular attractive forces between unlike molecules. As concentration of oxidation products in an oil increase, polar molecules at the water-oil interface become oriented, reducing interfacial tension.

The DuNouy tensiometer, used in making the test, consists of a sensitive torsion wire clamped at one end. The other end is free to rotate by adjusting a worm gear, to which a movable index is attached for showing torque applied. A ring is hung in a stirrup at the end of a balance arm, clamped to the middle of the torsion wire. A platform for the contained liquids is provided and adjustably mounted on a supporting arm secured to a heavy rod rising from the end of one of the legs of the instrument. With the container of test liquids on the platform and the ring immersed in the lower liquid, the platform is slowly lowered and torsion of the wire increased simultaneously so the torsion arm remains in the zero position. Reading at which the ring breaks away from the liquid is a measure of the interfacial tension of the liquid.

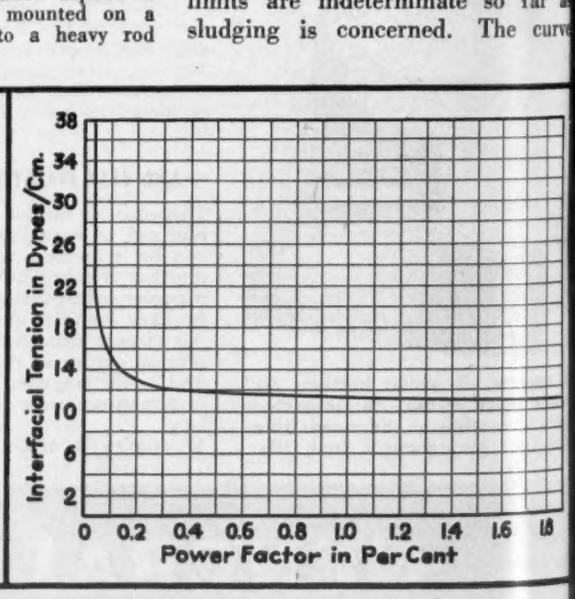
The accompanying curve shows the relationship between interfacial tension number and the findings of 3½ years' study, in which 124 transformers, ranging in size from 1,000 kva. to 18,750 kva., were internally inspected for sludge precipitation. Those inspected were ones having an interfacial tension number that led to the belief that the oil might be sludging.

It will be noted that all oils having interfacial tension number below 13 were found to be sludging, while those oils with numbers above 21 were found free of sludge. Oils having a tension number between these two limits are indeterminate so far as sludging is concerned. The curve

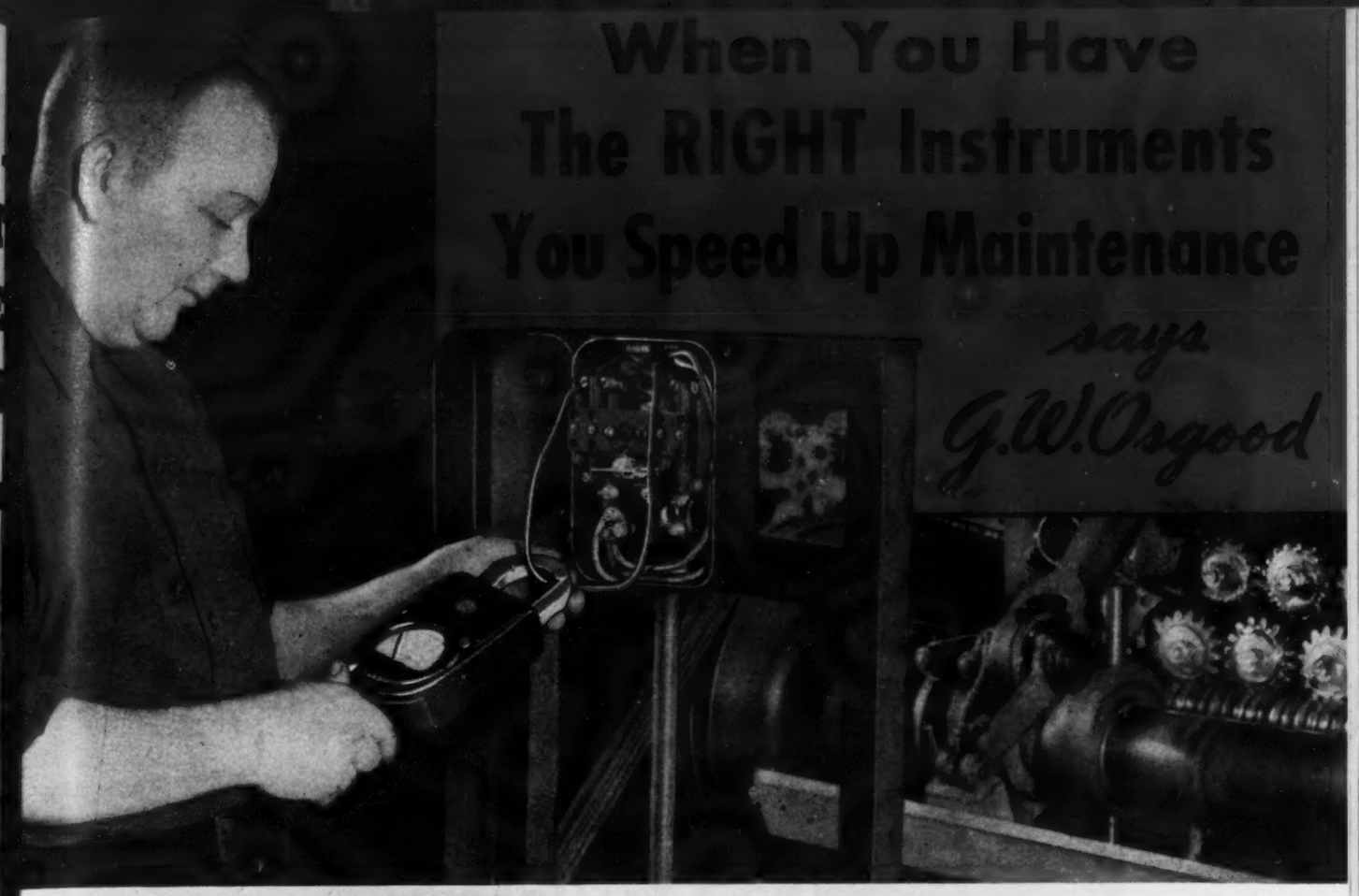
* Abstract of a paper presented before the January, 1943, conference of Doble Engineering Company clients, Boston, Mass.



TRANSFORMERS found sludging or not sludging at various values of interfacial tension



COMPARISON of power factor with interfacial tension of transformer insulating oil



When You Have The RIGHT Instruments You Speed Up Maintenance

says G. W. Osgood

WHICH OF THESE TESTING INSTRUMENTS DO YOU LACK?

AK-1

A-C HOOK-ON VOLT-AMMETER. The handiest of instruments for quick load checks—no cutting conductors or interrupting service. Measures volts also. Bulletin GEA-2950.

AP-9

MEDIUM-SIZE PORTABLE, A-C (AND DP-9, D-C). Accurate within ¾ of one per cent. Very portable—size only 2½ by 4¾ by 6½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

AS-5

POCKET-SIZE PORTABLE, A-C (AND DS-5, D-C). Accurate within one per cent. Slips easily into a coat pocket—size 2 by 3½ by 5½ inches. Price covers a 5-amp ammeter. Bulletin GEA-1784.

CF

INKLESS RECORDER, PORTABLE. An inexpensive instrument. Inkless—no pen to start and no ink to spill. Price covers a 5/10-amp ammeter. Bulletin GEA-9187.

CD

INK RECORDER, PORTABLE AND SWITCHBOARD. Ideal for use where a high degree of accuracy is very important. Price covers a 5-amp portable ammeter. Bulletin GEA-1061.

"**FOR QUICK LOAD CHECKS,** we find the General Electric hook-on volt-ammeter the handiest of all instruments. But, it is not a cure-all. There are times when we use an indicating instrument that has an accuracy even higher than the ±3 per cent of the AK-1.

"For still other work, we need a chart record of current or voltage taken during an entire cycle of operation of a single machine, or of an entire section of the plant—that's when we use a recorder.

"Having the *right* instruments available speeds up our preventive maintenance work."

Those are the words of G. W. Osgood, Electrical Department, Merrimac Hat Co., Amesbury, Mass.

Don't Handicap Green Hands by a Lack of Instruments

When experienced maintenance men like Mr. Osgood say it's important to have the *right* instruments, we can imagine how handicapped inexperienced men must be without them.

Still, you don't need a roomful of instruments. The five shown here will do 90 per cent of your testing work (prices are for estimating only). If you would like more information about them, ask the nearest G-E office for the bulletins listed. If these instruments won't answer, tell us what you need. We may have a standard instrument that will do the job. *General Electric, Schenectady, N. Y.*

The Army-Navy "E", for Excellence in the manufacture of war equipment, now flies over six G-E plants employing 100,000 men and women.

GENERAL ELECTRIC

602-28-6200

Every Day SINCE PEARL HARBOR 24,000 KVA of

These 17 months have brought A STILL BETTER PRODUCT WITH LESS MATERIAL, AND AT LOWER COST

HOW to greatly increase power-transformer production in the shortest possible time, *without* the time- and material-consuming procedure of *building new factories,* was a problem which our organization was already solving when the attack came December 7, 1941. Since then we have shipped more than 12,000,000 kva.

PRODUCTION STREAMLINED

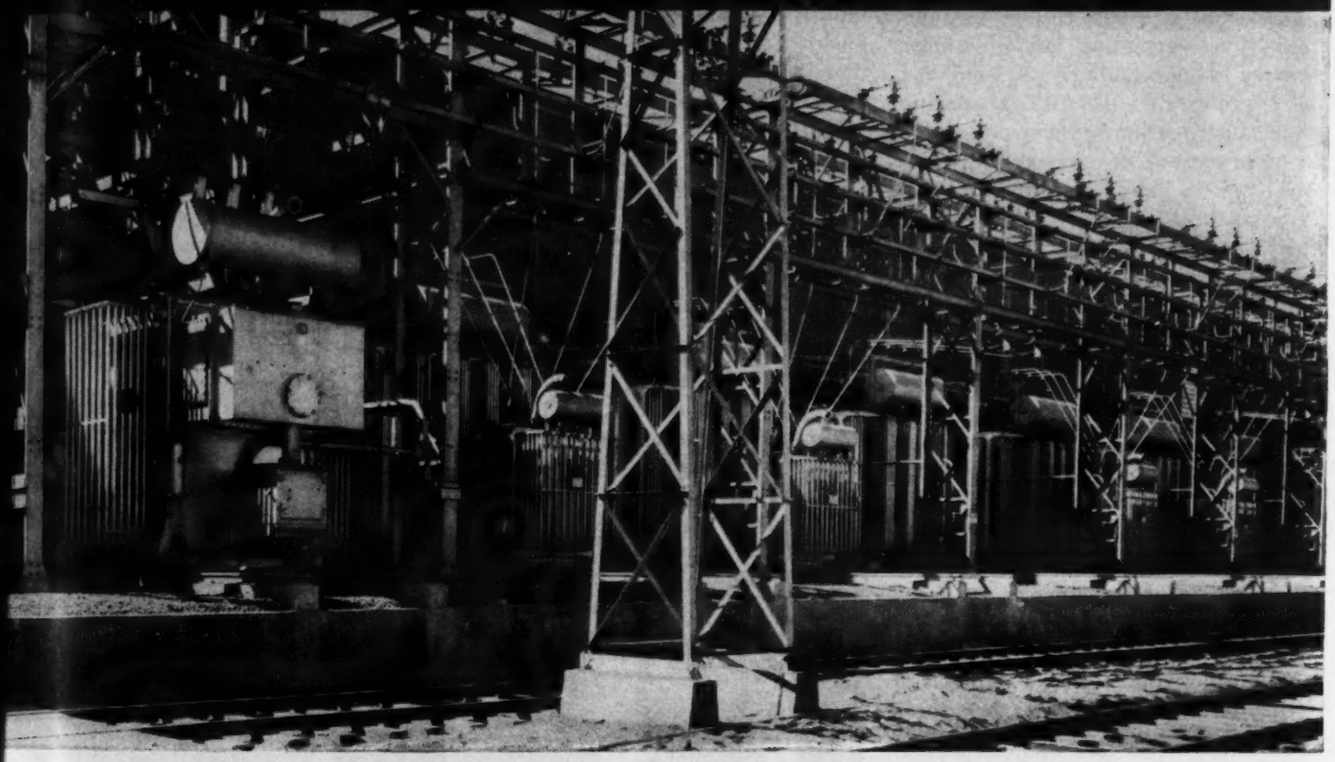
Before Pearl Harbor a far-sighted program had been launched to replace obsolescent equipment. To gear for war, our plant facilities were reorganized; manufacturing processes were regrouped; bottlenecks were anticipated and ironed out before they could develop. (For example, the facilities for vacuum drying of core-and-coils were augmented materially.) Experienced employees were given added responsibility and the opportunity to become leaders in the training of new personnel.

PURCHASER CO-OPERATION

Our customers, by allowing the duplication of existing designs; by recognizing the advantages of "packaged" unit substations and load-center power units; by using three-phase transformers; by specifying only standard accessories, have helped immeasurably to save skilled labor and production time. This has meant more power for war — FAST,

G-E POWER TRANSFORMERS

Have Been Placed in Service



G-E power transformers supplying a vital electrochemical plant in the West

and with the use of less critical material. Wherever possible, artificial means of cooling have been applied to transformers in service to increase system kva, rather than buying new transformers. Hence, the limited supply of new transformers could go to the spots where the need was greatest.

CRITICAL MATERIALS SAVED—AND BETTER POWER TRANSFORMERS

Not only was production accelerated because of repetitive manufacture, but also notable savings were made in critical materials, through the extensive use of cold-rolled core steel and by utilizing improved methods of cooling.

Today, as a result, you get a better transformer, and by "better" we mean not only improved all-round performance, but lighter weight, less floor space, larger sizes shipped in their own tanks, and all this at lower cost. *General Electric, Schenectady, N. Y.*

GENERAL ELECTRIC

401-13-5155

shows the percentage of transformers found to be sludging and those found to be free of sludge and are quite precise between these limits. Value of the curve in the range between these limits is in providing a factor from which the probability that an oil is sludging may be judged.

Preliminary test made by the Shell Company showed that no correlation existed between power factor of an oil and its interfacial tension. The apparent lack of correlation between the two, evident at first glance from the curve of power factor vs. interfacial tension number, is undoubtedly caused by varying moisture content of an oil sample. However, in further examination of this graph it will be noted that a curve drawn through points corresponding to the samples having the minimum power factor for any group of oils with a specific interfacial tension number does show a quite reasonable correlation. Obviously, then, since power factor of a given oil will vary widely with water content, in any one group of oils with a given interfacial tension number, the sample with the minimum power factor would have also the minimum water content. If any correlation of power-factor determinations with interfacial tensions or saponification number is to be attempted, anhydrous oil samples should be used.

During the past 3½ years Union Electric Company has accumulated 355 groups of transformer oil tests, including dielectric breakdown, neutralization number, power factor, NPA color number and interfacial tension tests. It is felt that these tests justify the conclusions set forth concerning the efficacy of such tests.

•

Lineman, Patrolman Training*—I

By C. T. MALLOY
Superintendent
Transmission and Communication Department,
Southern California Edison Co., Ltd., Los Angeles

As an aid to the apprentice who is being coached and trained in new work, and as a tool to be used by the foreman who may be a good supervisor but does not have natural ability as a teacher, a training schedule has been compiled for use of the transmission division field forces of the Southern California Edison Company.

The apprentice training schedule is divided into two classes: (1) Apprentice patrolman training and (2) apprentice lineman and second-class lineman training. Each apprentice in these classes is required to pass through four distinct steps to complete the training and be eligible for the rating of patrolman or first-class lineman. The training for the two classes is identical.

Minimum time periods for promotion and pay increases are: First three periods for six months each, and fourth period for one year. Salary increases are not granted on account of elapsed time, but only for industry, ability, perfection in accomplishment, and changes of classification where an employee is charged with added responsibility.

Qualifications for eligibility for apprentice training are:

1. Shall have had at least one year's experience as a groundman, and must be at least 20 years and not more than 30 years old unless he has had previous experience in line work. Any previous experience in rigging, working with ropes, etc., will be an asset.
2. Shall be mentally alert and physically fit. Must weigh at least 140 lb., and must be at least 5 ft. 7 in. tall.
3. Shall have had an education equal to two years of high school. The ability to write a good hand will be an asset.
4. Shall be of good character and not addicted to the use of alcohol or other stimulants.
5. Shall be willing to devote a portion of his own time in practice and study for advancement in this line of work.
6. Should have some mechanical ability.
7. Must own a complete set of approved lineman's tools.
8. Must have a pleasing personality, and shall, through his teamwork and harmonious relations with other employees, have demonstrated his ability to co-operate with others and his capability of assuming responsibility after he has received proper training.

Men who can qualify under the foregoing requirements are eligible to start the first step in training or probationary period, when there is an opening in the classifications.

Before apprentice can be advanced to succeeding steps in training, he must be able to assimilate some important features in transmission line work. Some features for the steps will be listed in subsequent issues.

*First of three articles on apprentice training for transmission line work.

• • •

Inclosure Protects Boiler Operator

Steel and glass inclosure around boiler controls is used at Port Washington station of the Wisconsin Electric Power Company to protect the operator from disturbances in the boiler room in case of trouble. Purpose of the inclosure is to permit the operator to remain at his post in the event of accidents that might fill the boiler room with steam, smoke or ash. Fresh air from the outside is forced into the inclosure by means of a fan. In the foreground are two feedwater control valves.

18 War Production Men report what happened *when lighting was improved*

GREATER ACCURACY

ELL FUSE manufacturer: Production increases of m 25 to 50 per cent as result of better inspection and re efficient machine operation.

OTOR TRUCK manufacturer: Workmen read mi- meters and scales more accurately.

XTILE manufacturer: Better Lighting a great aid color matching.

LESS SPOILAGE

OLLER BEARING manufacturer: Grinder operators ot improper grinder performance more quickly and correct it before work is spoiled.

ECTRICAL EQUIPMENT manufacturer: Better hting accompanied by five per cent reduction in rors.

CTORY OFFICE: Reduction in office errors as re- t of lighting.

FASTER SEEING

EAVY MACHINE TOOL BUILDER: Better lighting duces time required to rebuild a machine.

ECTRICAL EQUIPMENT manufacturer: Time re- ired for machine set-ups reduced.

RCRAFT PARTS manufacturer: Less time lost by rkmen hunting for tools.

EASIER SEEING

MP manufacturer: Time for training new women erators greatly reduced.

MALL MACHINE PARTS: Men can read scales and ueprints more easily at night than by daylight.

CTORY OFFICE staff: Unable to keep up with in- eased work under old lighting, but now work is done thout undue effort.

INCREASED SAFETY

ORDNANCE PLANT: Increased safety, especially when breaking in new labor.

SHIP BUILDER: New lighting reduced blinding effect of flashes from welding torches.

TEXTILE manufacturer: Decreased fire-hazard.

DECREASED FATIGUE

MACHINE PARTS manufacturer: Men on night shift gained weight.

AIRPLANE PARTS manufacturer: Morale improved; fewer yard fights.

AIRPLANE PARTS manufacturer: Fewer headaches; aspirin tablet consumption decreased from 1000 to 600 tablets per month.

What are you doing?

The 18 comments summarized on this page are typical of the wide range of benefits resulting from lighting improvements.

They are typical of the kind of results lighting men can and are getting when they check up on war plant lighting and suggest simple changes to correct lighting bottlenecks—changes that require a minimum use of critical materials.

To date these lighting men—the representatives of electric service companies, electrical wholesalers, and contractors, lighting equipment manufacturers—have barely scratched the surface of this job that's so important to the war effort.

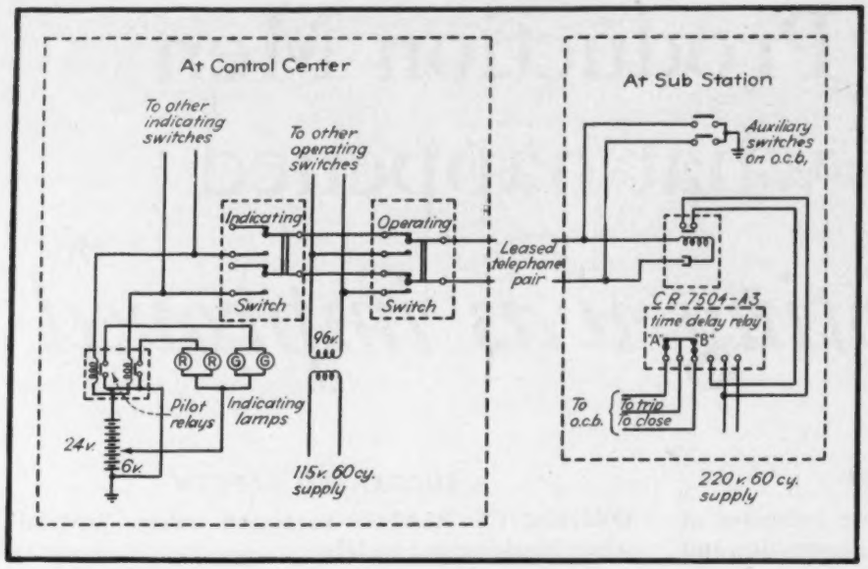
What are you doing in your own territory, for example, to help newly converted war plants and shops speed production with better light?

General Electric Company, Nela Park, Cleveland, O.

* *These reports are the result of a survey of war plants made under the direction of a special committee of the Illuminating Engineering Society, a non-profit professional organization of the nation's leading lighting authorities. Interviews were made by teachers of illuminating engineering of five leading technical colleges.*

G-E MAZDA LAMPS

GENERAL ELECTRIC



SCHEMATIC DIAGRAM of control for rapid cutting out and restoration of street lights from an operating center

Area Street Lights Have Blackout Control

By W. A. UPHAM
General Superintendent of Distribution
United Illuminating Company
New Haven, Conn.

Street lighting in the New Haven area has been furnished through groups of from four to seven "R O" transformers installed at various substations. Eleven of these groups were formerly controlled by time switches. A few installations also used photoelectric controls in conjunction with the time switches. When the necessity for immediately blacking out all street lights was announced, it became necessary to develop a scheme where the control could be centered at one point. Several methods were considered, but the one finally decided upon called for the use of a leased telephone pair from the distribution dispatcher's office to each individual substation. A schematic diagram showing the relays and power sources required is shown on the accompanying drawing.

To trip the circuits the control key is momentarily depressed imposing 96 volts, 60 cycles a.c. on the telephone pairs. This actuates a telephone relay at the receiving end which closes the circuit through a time-delay relay. This relay has two sets of contacts, one of which (A) is normally closed and the second (B) which closes after a predetermined time. (In this case approximately six seconds.) In the tripping operation contact is made through the normally closed contacts so that the oil circuit breaker controlling the group of "R O's" at the station in question is immediately opened.

When it is desired to re-energize these circuits the same key is depressed, but it is held closed for about ten seconds. The normal impulse is, of course, to again trip the breaker, but after the predetermined interval has elapsed the second contact closes at the same time the first opens, thus completing the closing circuit and the street lighting transformers are again energized.

Indicate Breaker Position

It was felt that supervisory control was necessary in order to assure the operator that the breakers were in the desired position. This was accomplished over the same pair of telephone wires by installing an indicating switch. This connects a 24-volt battery consisting of twelve dry cells to the line. A condenser is inserted in series with the operating coil of the telephone relay at the substation to insure correct ground indication and to prevent possible false operation of this relay. Just ahead of this condenser connection leads are taken to auxiliary switches mounted on the oil circuit breakers which ground one side of the telephone line when the breaker is in the open position and the opposite side when the breaker is closed. At the control end of the circuit telephone relays are installed —one on each side of the line. These are connected to a common grou so that the relay which is connect to the grounded side of the telepho pair operates.

Indicating red and green lights multiple are connected to these rela so that the proper indication is reg tered on the control panel. The lights are connected multiple, so th in case of a lamp burnout indicatio will still be received. All contr switches and indicating lights ar mounted in a compact box on th dispatcher's desk. The box als houses the relays and the battery.

A master switch has been provide on the a.c. control at this point s that it is impossible for accidenta contact with the control switches t cause the circuits to trip. It has bee found that this system has sufficien capacity to trip and reclose severa units at the same time, so that it i now possible to extinguish all stree lights in this area in less than fiv seconds and to turn them on again in about one minute.

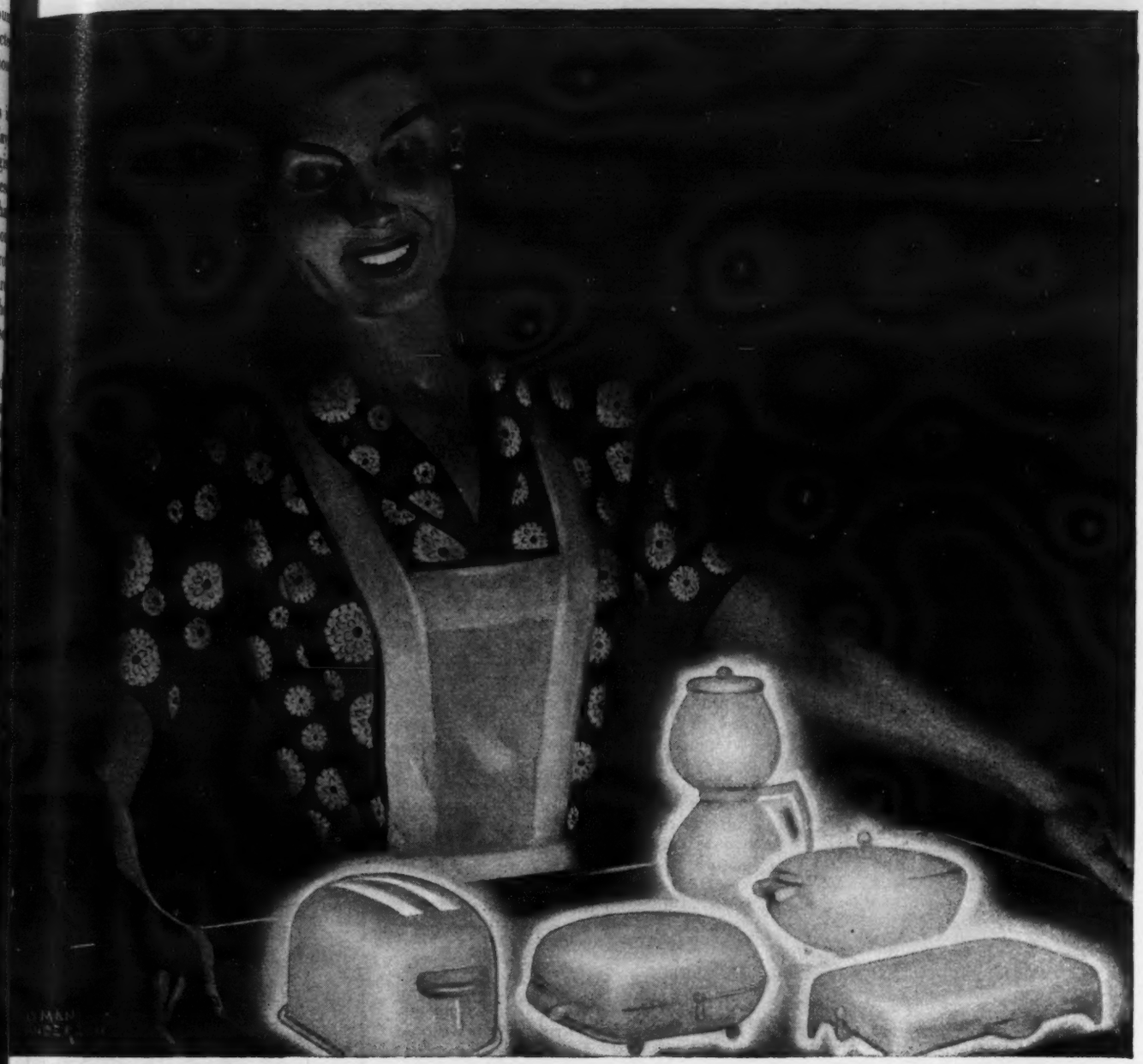
•

Pole Support

Excavation for a vault directly under this heavily laden distribution pole proceeds quite normally with the guyed pole supported above it on two pairs of 8-in. I-beams. Two 16-ft. beams and two 12-ft. beams were bolted to each side of the pole as shown. When the vault was com-

Pole supported by I-beams, during excavation for vault directly underneath

pleted the pole was moved a few feet and reset to avoid resting it on the vault roof. The picture was taken on the system of the City Utilities, Fort Wayne, Ind.



Every wife is still a bride-to-be

AT the end of the war American wives will want to be brides all over again, start housekeeping afresh, refurnish their homes and refurbish their lives with sparkling new possessions for happy living. Not only new articles to replace the old and worn, but entirely new models that make it more fun to keep house. Automatic kitchen equipment, electrical appliances that make better waffles, coffee, toast . . .

Paradoxically, in an era of plenty, the manufacturer's chief problem may be materials. Not because there will be too few, but because there will be so many!

In addition to all the familiar materials, there will be a bewildering array of new ones. Metals that once were rare and costly. Entirely new alloys to complement those for which Revere is renowned. Strong, rust-proof, beautiful. But which should be used for what purpose?

For impartial answers to questions about metals, industry can turn to Revere. For just as industry in the future will not be restricted to the traditional materials, neither will Revere. In addition to widening still further the uses for copper and its alloys since the start of the war, Revere has developed facilities for manufacture of the light metals, and is pioneering in the production of wholly new alloys that can cut manufacturing costs for many industries.

Today the copper industry is producing only for war. No copper is available for anything else. But post-war planners with specific problems in metals are referred directly to the Revere Executive Offices in New York.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

Executive Offices: 230 Park Ave., New York

HOW THE AMPLIDYNE FUNCTIONS—I

By FREMONT FELIX
Industrial Engineering Department,
General Electric Co., Schenectady, N. Y.

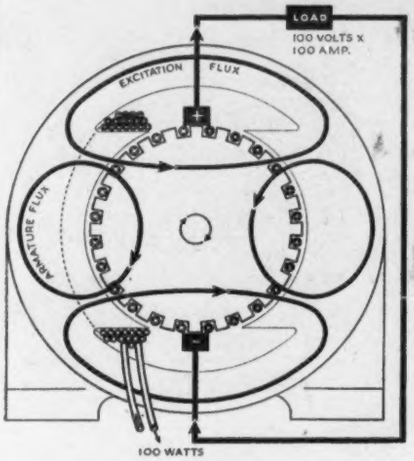
The amplidyne is an externally driven d.c. generator, outwardly similar to a conventional motor or generator. It gives an output 10,000 times (or more) greater than the exciter input, within 1/10 second (or less) after excitation is applied. As small as ½-watt excitation gives full armature flux because the conventional brushes are short circuited. The armature flux produces full-load voltage between two new brushes added in the center of each armature flux loop. A compensating field neutralizes any tendency of the new load current to set up its own armature flux.

A normal complement of four control fields on the same pole structure permit many independent functions to control the output, the amplidyne responding to the resultant action of the fields. One control field set up as a standard of reference is generally energized by a constant source, and tends to make the amplidyne deliver maximum output. This tendency is opposed by the other control fields, resulting in a net excitation of the right amount and direction to maintain desired result.

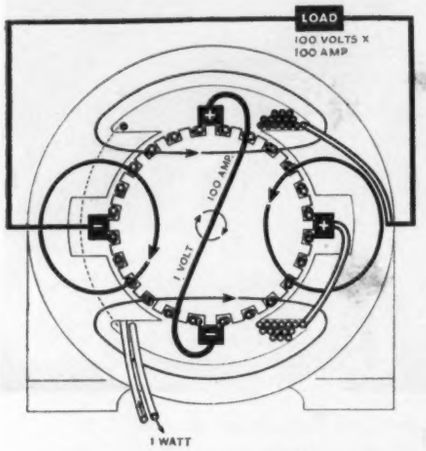
In the connection diagrams the reference field which tends to increase the amplidyne output is shown pointing ^, and the control fields which oppose the reference field are shown pointing down V.

Minute excitation input requirements for the amplidyne are of the same magnitude as the output of high-vacuum electronic tubes, making the amplidyne a natural partner of electronic devices in the control of large machinery.

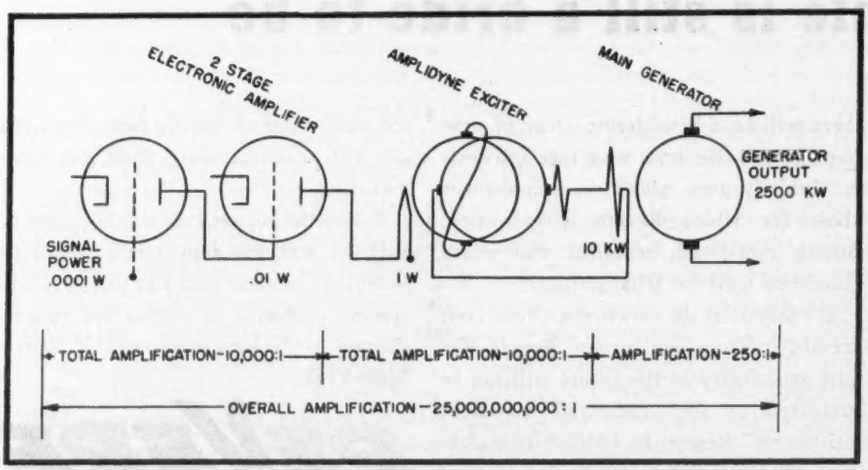
By itself the amplidyne can perform a variety of control functions either supplying directly the power of the drive or enhancing the operation of much larger electrical equipment. Two control functions are shown in accompanying illustrations; others will be shown in a subsequent issue.



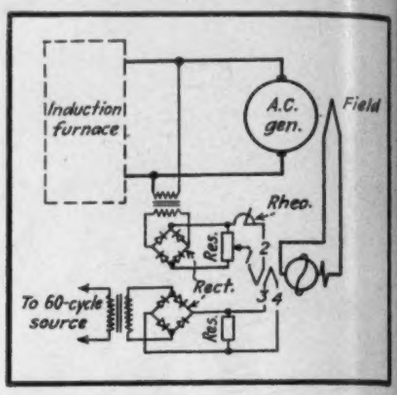
A CONVENTIONAL two-pole, 10-kw. generator; armature flux is idle; 100 watts excitation is required for 10-kw. load



A 10-KW. AMPLIDYNE: conventional brushes are short circuited; one-watt excitation produces full armature flux and full voltage between two new brushes, giving 10-kw. full load

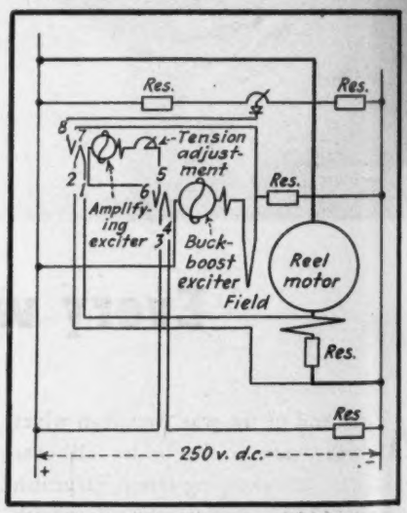


SYMBOLIC illustration of power control showing example of use of amplidyne in conjunction with electronic amplifier



VOLTAGE control. Amplidyne used as a voltage regulator on a high-frequency generator

Reference field (3-4) is excited by constant-voltage power supply and opposes control field (1-2), excited by main generator output voltage. Control field is connected in series with a generator voltage—adjusting rheostat (rheo.). Amplidyne output excites the main generator, speeding up its response and quickly correcting for load changes.



CURRENT control. Large reel motor can be made to operate over a wide speed range, automatically holding constant current and tension throughout reel build-up

Close regulation over a wide range of tensions is obtained by using the reel-motor current to signal one amplidyne, which, in turn, excites another. Second amplidyne, in a "buck boost" connection, supplies the reel-motor field. A speed-limit feature keeps the motor speed within safe limits during threading and when tension is released.

PHILCO

THROUGH MODERN DESIGN
BRINGS YOU THIS SENSATIONAL

VITRABLOC STORAGE BATTERY

Philco Floté in Vitrabloc is the most attractive industrial storage battery ever made. Pure white, highly glazed, Vitrabloc brightens dark battery rooms.

FOR CONTROL AND STAND-BY SERVICE

Even in peacetime, Philco Vitrabloc would be a tremendous advance in storage battery construction. Today, when batteries must do a bigger job . . . when critical materials are a problem—Vitrabloc is a truly sensational development!

Philco Vitrabloc batteries give you greater capacity without increase in battery space. Vitrabloc incorporates the exclusive Philco Floté principle, the only construction specially designed for modern, full float service. Vitrabloc cells are explosion-proof and spray-proof.

Best of all, no critical materials are used in this vitrified ceramic jar. As a result, Philco Vitrabloc is available on exceptionally low priority!

Write for complete information or call in your local Philco representative. There's a Philco Battery Sales Agent in every important industrial center!

PHILCO CORPORATION, STORAGE BATTERY DIVISION, TRENTON, NEW JERSEY

REPLACE WITH RUGGED, HIGH-CAPACITY PHILCO BATTERIES

Phase Transformation of Single-Phase Load

By W. R. BROWNLEE

Engineer, Electrical Engineering Department, Commonwealth & Southern Corp., Jackson, Mich.

A possible method for transforming single-phase loads of low power factor, such as welding loads, into balanced three-phase loads of 86.6 percent power factor (lagging), using a capacitor and two reactors, was published in ELECTRICAL WORLD, September 5, 1942, page 62. No values, however, were given of the size, impedance, etc., of the auxiliary equipment. Calculations can be made showing that by choosing the proper values for the auxiliary equipment, for any particular load and power factor, the indicated transformation may be made.

For convenience in calculation the particular example chosen is a single-phase, 100-kw., 200-kva., 50 percent power factor, 2.4-kv. load, which is transformed to a three-phase, 2.4-kv. load of 100 kw., 115 kva., 86.6 percent power factor (lagging).

To produce the results indicated, using the basic scheme outlined in the previously mentioned article, the required capacitor must have 50 ohms capacitive reactance, will have a normal steady state voltage of 3,670 volts, a normal current of 73.5 amp., or a rating of 270 kva. Two reactors are required (although the article might imply a single reactor with a mid-tap). The reactor nearest the load must have an inductive reactance of 25 ohms, will have a normal voltage of 1,383 volts with a normal current of 55.5 amp., or a rating of 76.9 kva. The reactor in series with the odd lead must have an inductive reactance of 100 ohms, will have a normal voltage of 2,780 volts with a normal current of 27.8 amp., or a rating of 77.3 kva. To avoid possible transient effects, reactors should probably be of the air core variety; both capacitors and reactors would be special.

The attached vector diagram indicates the magnitude and phase relationships of the various currents and voltages.

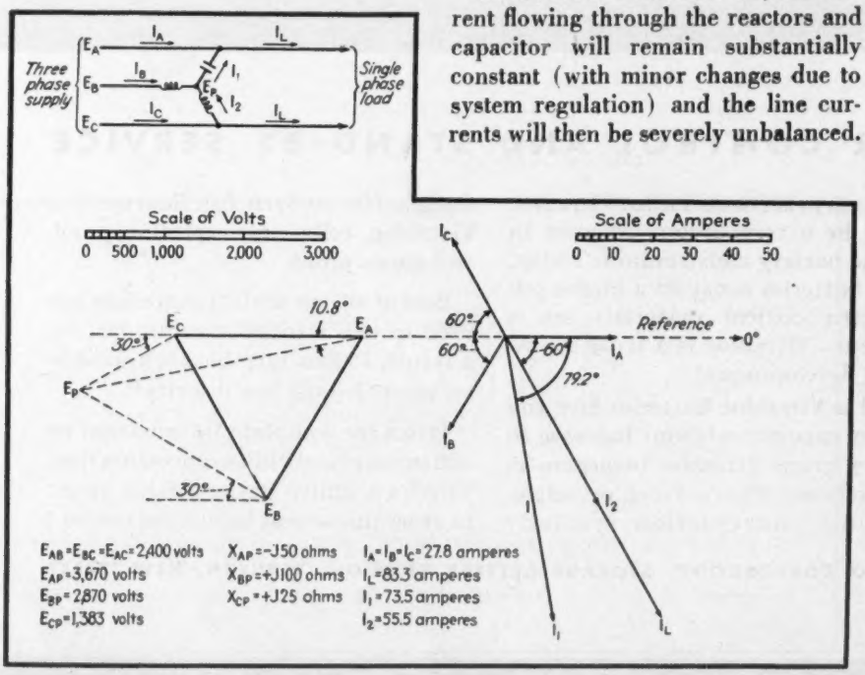
Several general conclusions may be drawn concerning the proposed arrangement. These may be summarized as follows.

The single-phase to three-phase transformation may be made as indicated, for example, correcting a single-phase, 50 percent power factor load to a balanced three-phase, 86.6 percent power factor (lagging) load at a cost of about $20 per load kva.

Since the scheme is similar to a shunt capacitor rather than a series capacitor scheme it is unsuitable for varying load applications, such as flash type welders or single-phase arc furnaces, where the load variations are the principle cause of flicker.

If the load is switched off, the current flowing through the reactors and capacitor will remain substantially constant (with minor changes due to system regulation) and the line currents will then be severely unbalanced. *On an incremental basis, the change in voltage on the loaded phase when the load is switched on or off will be just the same as if no correcting equipment were present.* The scheme, therefore, does not provide improvement for flicker situations unless multipole switching is used.

If a three-phase capacitor bank is added to bring the power factor of the phase-transformed load to unity instead of 86.6 percent, the total capacitors required will be 328 kva. (plus the same reactors), compared with only 173 kva. of capacitors which could be connected in series with the 200-kva., single-phase load to provide unity power factor operation, single phase. The relative costs are about $25 per kva. and $8 per kva. of single-phase load, respectively. However, the phase-balancing scheme would have the advantage in this case of reducing voltage variation due to the in-phase component of load current acting on the supply circuit resistance to one-half of the value which would be encountered with the single-phase load corrected with series capacitors to unity power factor.



VECTOR DIAGRAM for transformation of single-phase load of 100 kw., 200 kva., 50 percent power-factor to three-phase balanced load of 100 kw., 115 kva., 86.6 percent power factor. (Top) Basic scheme ("Electrical World," September 5, 1942, page 62)

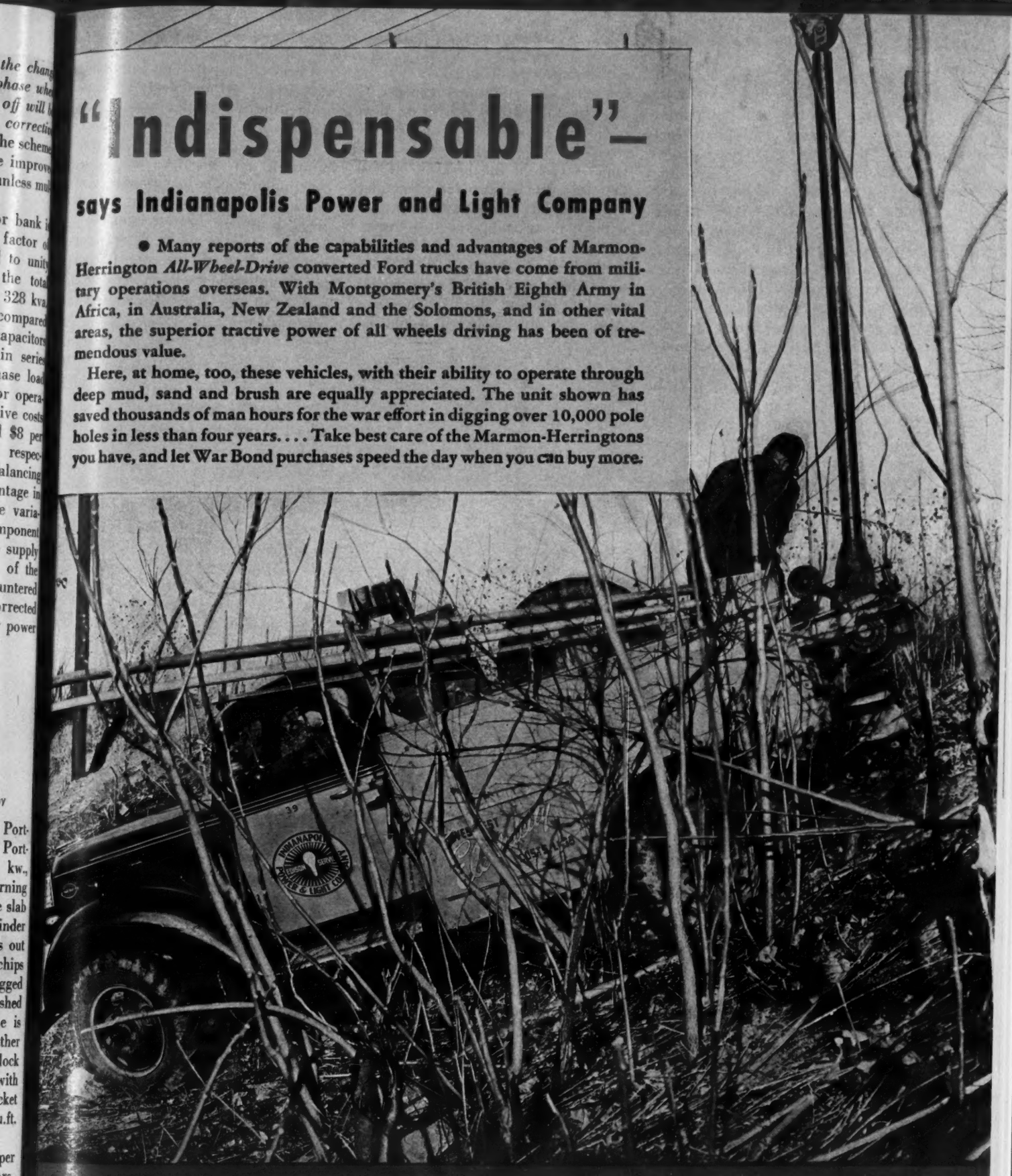
Burning Sawmill Waste

By FRANK H. BOOTHBY

Chief Operator
Portland General Electric Company

Station L steam plant of the Portland General Electric Company, Portland, Ore., is rated at 77,000 kw., the largest plant in the world burning sawmill waste. Sawmills run the slab and waste wood through a grinder called a hog and the fuel comes out looking very much like coarse chips and is known as sawdust or hogged fuel. Part of this fuel is furnished by a near-by sawmill and some is brought in on river barges from other localities and unloaded at our dock by means of a hoist equipped with a specially designed 200 cu.ft. bucket which will unload about 10,000 cu.ft. per hour.

The fuel is dumped into a hopper and carried by thirteen conveyors, all operated from one control station, into the boiler room or out onto the storage pile, depending on operating conditions. It is piled or taken off the pile by means of cable-drawn rakes operated by electric donkeys, which rake the fuel into or away from



"Indispensable"—

says Indianapolis Power and Light Company

● Many reports of the capabilities and advantages of Marmon-Herrington *All-Wheel-Drive* converted Ford trucks have come from military operations overseas. With Montgomery's British Eighth Army in Africa, in Australia, New Zealand and the Solomons, and in other vital areas, the superior tractive power of all wheels driving has been of tremendous value.

Here, at home, too, these vehicles, with their ability to operate through deep mud, sand and brush are equally appreciated. The unit shown has saved thousands of man hours for the war effort in digging over 10,000 pole holes in less than four years.... Take best care of the Marmon-Herringtons you have, and let War Bond purchases speed the day when you can buy more.

MARMON-HERRINGTON

All-Wheel-Drive

MARMON-HERRINGTON CO., Inc., INDIANAPOLIS, INDIANA

Cable Address: MARTON

the conveyors. The fuel is stored in a pile sometimes as high as 135 ft., covering 13 acres and containing about 13,000,000 cu.ft. of fuel, which is sufficient to make about 48,000,000 kw.-hr.

Moisture content of this fuel as it comes from the mill is about 45 percent, which later increases to near 55 percent as the fuel is piled outside and exposed to the weather. It burns very rapidly under forced and induced draft and when a boiler has been properly banked it can be pulled up to full load almost instantly. Boilers are equipped with water-cooled grates and very little slag is formed with clean fuel. Under forced draft some partly burned fuel would be carried up the stack and these cinders are removed from the flue gases by means of cinder eliminators and rotary filters and put back into the fires. The boilers operate on 425 lb. steam pressure; some are equipped to burn fuel oil as the supply of hogged fuel is not sufficient to operate the plant throughout the year.

•

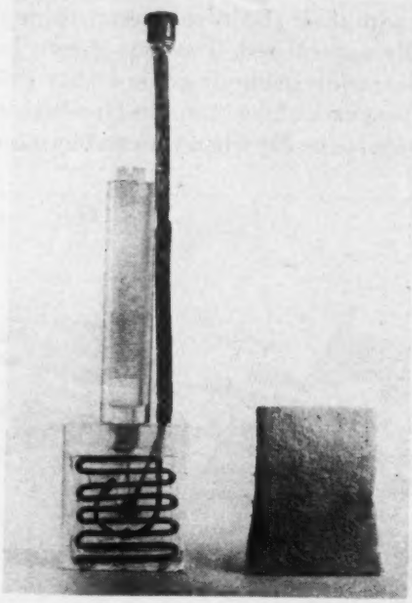
Breaker Contacts Plated in Place

By A. C. ZEESE
Consolidated Edison Company of New York, Inc.

Studies have been made to determine the possibilities of silver plating the 10,000 air circuit breakers on the d.c. system of the Consolidated Edison Company of New York, Inc. They differ in manufacture, size and design, but all have laminated copper brushes. Certain breakers have laminated copper brushes so designed that the first lamination to strike the fixed contacts moves at least $\frac{3}{8}$ in. after first striking the contact before coming to rest when the breaker is completely closed. The last lamination to strike the fixed contacts moves approximately $\frac{1}{8}$ in. Other breakers are so designed that the laminations hardly move as the breaker is closed. These variations depend on the angle at which the brush is cut and the pressure applied.

Cost of removing a 20,000-amp. circuit breaker weighing over a ton to a shop was prohibitive and in most cases it was impossible to remove the brush arms and fixed contacts without taking the breaker down completely. The cost of maintenance of 1,000-amp. circuit breakers was so low that the additional expense of removing them and delivering them to a shop to be silver plated was entirely out of proportion to the maintenance cost of the breaker. It was therefore decided that the silver plating would have to be done on the job without dismantling the breaker.

None of the commercial "brush" methods could be used in the confined space between the copper-laminated brush and the fixed contacts. Also, the silver solution would fall



GRID (2 in. square) of No. 10 silver wire as anode set flush in recessed piece of Lucite (2½ x 3 in., thickness ¼ to 1 in.). Hollow round Lucite handle tapped for ⅜-in. threaded Lucite plug. Photographic sponge (2½ x 3⅛ in.) placed over grid to retain electrolyte

off the tool onto the various parts of the breaker.

The brush method of silver plating was studied and a new device (shown) developed small enough to get into the small spaces.

The Lucite plug was used to force the commercial silver solution into the cavity and onto the sponge. When the sponge became saturated with silver solution the tool was ready to use. A positive d.c. supply was attached to the silver anode through a variable resistance and the copper to be plated was grounded. A current of approximately 1 amp. gave the best results. The device was continually moved over a small space. As the sponge became dry more silver solution was forced on to the sponge, keeping it saturated at all times.

Chemical preparations for cleaning the copper are satisfactory if used where the chemical cleaning action can be neutralized or washed off with a liberal amount of water. Realizing, however, the difficulties in chemical cleaning of copper on circuit breakers mounted in substations, it was decided to use an abrasive. For circuit breaker work the use of No. 00 emery paper to clean off the copper oxides was found satisfactory. Only a small surface of the breaker was cleaned before plating because copper exposed to the air oxidizes quickly.

Silver Deposit

The device will deposit approximately 0.001 in. of silver on a flat surface 3 in. square in 20 minutes; 0.0005 is sufficient for normal circuit breaker use. If the circuit breaker has a stiff brush 0.00025 in. is satisfactory; if a soft brush is used, approximately 0.00010 in. is suitable. The silver plate will last longer on brushes under slight pressure than the silver plate on brushes under heavy pressure. No effort should be made to form a solid mass of silver over the brush surface.

The thickness of silver plate suggested will permit approximately 250 operations of the circuit breaker before noticeable wear is apparent. The number of operations of the circuit breakers on the Consolidated Edison system varies from two operations per year to 400 operations per year; average is probably no more than 25 times per year.

About 300 circuit breakers have been silver plated. A group of sixteen 20,000-amp. circuit breakers located in a d.c. substation that had been giving us trouble due to excessive heating were silver plated in December, 1941. After silver plating these circuit breakers have carried heavy loads without excessive heating. At another substation a group of eight 20,000-amp. circuit breakers indicate a slight rise in the contact resistance across the fixed contacts of these breakers during the first three months and then a fairly constant contact resistance during the last nine months.

Our experience has shown that air circuit breakers with laminated brush construction can be successfully silver plated in the field, that excessive heating due to high contact resistance can be overcome and that maintenance costs can be reduced.

Over-Zealous Workmen

CAN'T PREVENT THE TRIP!

AMBIENT TEMPERATURE WILL NOT AFFECT ITS PERFORMANCE

Incorporated in the many features of the Thermaload V is the exclusive Monitor Compensated Overload Relay. It assures perfect starter operation, gives positive motor protection, regardless of installation characteristics and ambient temperatures. Whether your motors operate in boiler room heat or sub-zero cold—the trip always occurs within the same time at a given percentage of overload.

OTHER FEATURES:

Vertical, Straight-Line Design; Double-Break, Silver Contacts; Easily Interchangeable Coils; Resilient, Shock-Proof Mounting.

Available in—1.3 to 7.5 H.P.—110 to 550 Volts (A.C.) and in combination units. All sizes carry the Underwriters' Seal of Approval.

This Monitor

COMPENSATED OVERLOAD RELAY

GIVES YOU "TAMPER-PROOF" MOTOR PROTECTION

Built into the Thermaload V Solenoid Starter, the Monitor overload relay gives you a *further* safeguard for your almost irreplaceable motors—the reset button cannot be blocked in by operators who are inclined to exceed the "safety-factor" in these days of speeded-up production.

The reset button must be pushed in and then *released* before contact is made. "Blocking the overload" is thus prevented!

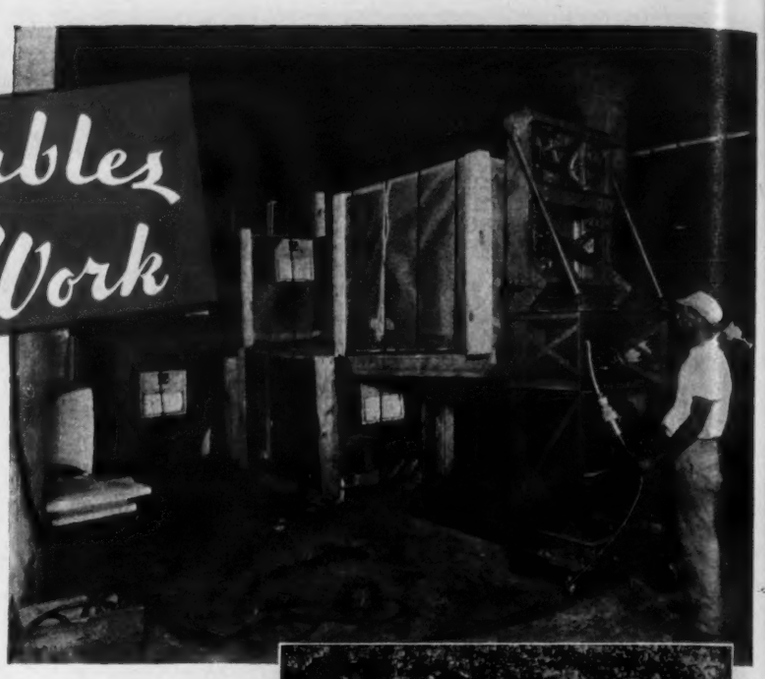
Ingenious? Yes . . . but typical of Monitor design . . . to give you the utmost in motor protection. Specify the Thermaload V for original equipment and replacement.

Write manufacturer or your Monitor field engineer for technical data and installation details.

The Monitor Controller Company

GAY, LOMBARD & FREDERICK STS. BALTIMORE, MARYLAND

Trailing Cables FOR Vital WAR Work



TIREX - rubber sheathed - cables were designed for hard, rough work. They still have remarkable wearing qualities and abrasion resistance and can be depended upon for continuous, dependable performance but, for the duration of the war, they meet restrictions governing the use of rubber, copper and other scarce materials.

It is important, now more than ever before, to get maximum service from trailing cables upon which portable or mobile electrical equipment depends for current. New cables are hard to get and those already in service must be used until they are completely worn out. To this end we make four suggestions.

1. As far as possible use the proper size and type of cable for the work to be done.
2. Provide extra protection or change location where exposure is hazardous.
3. Inspect cables frequently and regularly to discover conditions that may cause trouble.
4. Make repairs promptly when needed.

If you must have new cables for vital war work we shall be pleased to do anything we can, consistent with conservation restrictions, to help you get what you need.

Simplex Wire & Cable Co., 79 Sidney Street, Cambridge, Mass.

ARMY E NAVY

Simplex WIRES and CABLES

LOOP SYSTEMS AND THEIR ESSENTIALS*

By JOHN S. PARSONS and H. G. BARNETT
Industry Engineering Department, Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

Loop-type of distribution system is used where continuity of service is of considerable importance; it provides good voltage conditions and two-way feed to the distribution transformers or secondary substations. Each end of the loop-primary feeder (LP) is connected to the distribution substation low-voltage bus (DB) through a primary-feeder breaker (PB). Loop-primary feeder must have adequate capacity to carry entire connected loads when either end section is out of service, without excessive voltage drop in the feeder or overheating of the respective conductors.

In the secondary substation the transformer (T) ordinarily supplies the low-voltage feeder (LV) with a utilization voltage of 600 volts or below.

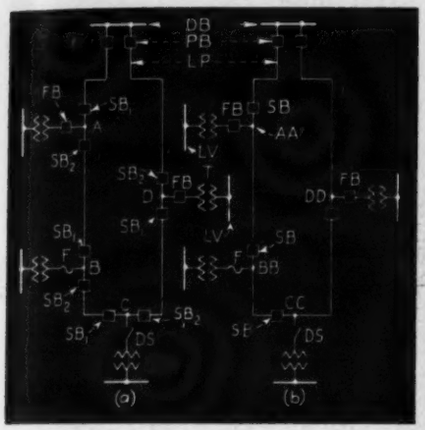


FIG. 1—Loop-type distribution system for supplying bulk industrial and commercial loads

In a most common system (Fig. 1a) serving bulk load the feeder is sectionalized by a circuit breaker on each side of the points where secondary substations with distribution transformers (T) are connected. The two primary-feeder breakers (PB) and the sectionalizing breakers (SB1 and SB2) are ordinarily controlled by directional-overcurrent relays or by pilot-wire relays. Pilot-wire relaying is used where the number of secondary substations connected to the loop is such that selective timing cannot be obtained with directional-overcurrent relays.

A fault on any section of the loop is cleared by the circuit breakers (PB or SB2 and SB1) at the ends of the faulty sections and service is not interrupted to any secondary substation.

A fault in a secondary substation transformer is cleared by the circuit breaker or fuse in its primary leads, or by tripping the two sectionalizing breakers (SB1 and SB2) when there is no breaker or fuse in the primary leads. In the latter case the loop can be closed after the disconnecting switch (DS) is opened.

In Fig. 1b one sectionalizing breaker is used with each secondary substation, thus reducing the number of breakers (by one-half) and investment in sectionalizing breakers and relaying. Except for primary-feeder faults, this system functions similar to the one in Fig. 1a.

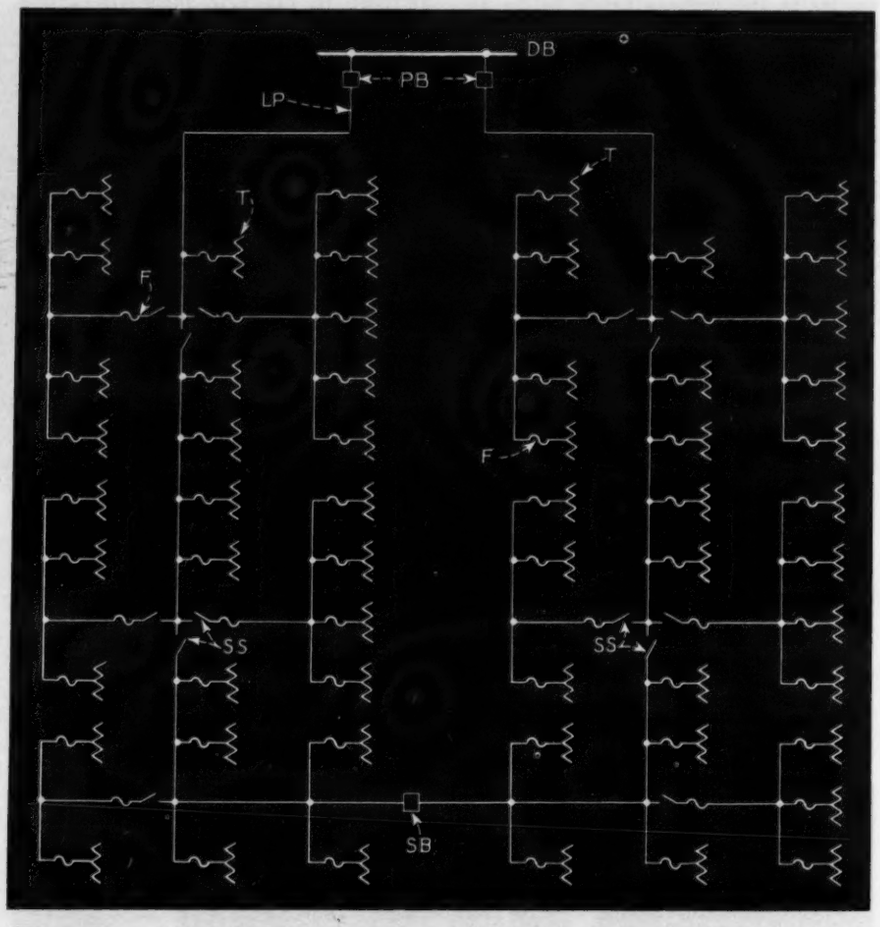


FIG. 2—Loop-primary feeder for supplying distributed loads as in residential districts

When a primary-feeder fault occurs the two breakers at the ends of the faulty section open as in the previous arrangement. In this case, however, the secondary substation associated with the faulty section is de-energized. Service to the de-energized substation cannot be restored until the fault has been located and repairs made.

An exception is a fault in the left feeder section just beyond the distribution substation bus which does not interrupt service to any of the secondary substations. Breaker SB could be omitted at connection AA, but then the substation is de-energized at the time of a fault in this section.

In a common system for supplying distributed loads as shown in Fig. 2, the main feeder is automatically sectionalized near its midpoint by a sectionalizing breaker (SB) controlled by overcurrent relays. This breaker could be replaced by fuses at some sacrifice in the speed of restoring service. More than one breaker could be used in the main loop with directional overcurrent or pilot-wire relaying to reduce extent of outage when a main feeder fault occurs.

Manually operated sectionalizing switches (SS) are used at points on the main feeder to reduce the area that must remain without service, until repairs are made, when a fault occurs on the main feeder.

Faults on subfeeders and laterals are cleared by their associated primary fuses which are used for economic reasons.

* Adapted from advance pages of forthcoming supplement to "Electric Transmission and Distribution Reference Book."

Gas-Filled Cable Pothead Compoundless

By J. H. NICHOLAS
Laboratory Engineer
G & W Electric Specialty Company, Chicago

Co-ordination of internal and external dielectric strengths so that flashovers would occur over the outside of the pothead has been achieved in a gas-filled pothead using an insulated stress relief cone that is externally shielded and co-ordinated with a properly shaped porcelain insulator. Investigation covered single-conductor potheads for gas-filled cables in the voltage range up to 46 kv., maximum. When the new design principles are incorporated in compound and oil-filled potheads a marked improvement results in dielectric strength and reliability.

Greatest electrical stress of a cable is usually at the termination of the cable sheath or shielding tape inside the pothead. General practice has been to reinforce the cable insulation at the end of the sheath or shielding tape by building up a stress relief cone of varnished cambric tape and copper tinsel braid, which increases the dielectric strength of the cable radially at this point, but does not materially increase the dielectric strength longitudinally along the cable insulation.

Accompanying illustrations of 60-cycle corona tests (Fig. 1 ab) show a cable with the usual design of stress relief cone and with air as the surrounding dielectric. Corona streamers hug the surface of the cable insulation because the cable insulation has a higher specific inductive capacity, S.I.C., and a higher dielectric strength than air or nitrogen at low pressures; the air ionizes because it is over-stressed.

One method of partially suppressing the surface ionization is to imbed the stress relief cone metal shielding in a solid dielectric of greater S.I.C. and dielectric strength than gases at low pressure—so that more of the electrostatic flux will be within the solid dielectric.

With the stress relief cone modified by a ¼ in. thick wrapping of varnished cambric tape over all, the percentage increase in 60-cycle flashover value (Fig. 1 cd) was 40 percent.

To obtain the desired results by means of the modified stress relief cone alone would require a pothead of much greater size than the standard compound- or oil-filled design. Having arbitrarily limited the size of the gas-filled pothead to the approximate dimensions of the compound or filled type, an additional means of increasing the internal dielectric strength in the axial direction was necessary. It was found that the flux concentration or dielectric stress at the end of the stress relief cone metal shielding can be reduced by providing an external shield so incorporated into the pothead design that some of the electrostatic flux will be diverted from the internal stress relief cone to the external shield.

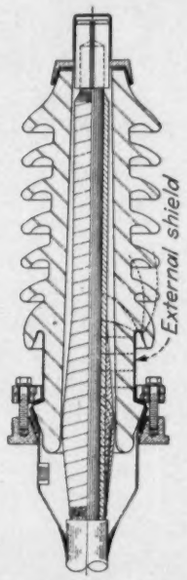


FIG. 2—External shield in new pothead design diverts some of electrostatic flux (dotted lines) from the internal stress relief cone to external shield

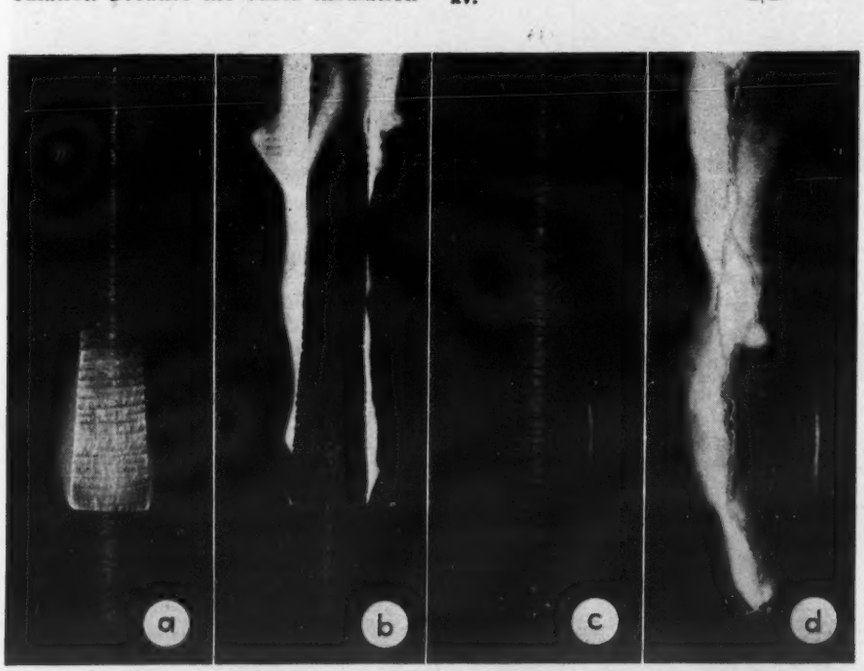


FIG. 1 — Corona streamers on a cable with the conventional form of stress relief cone start at 15 kv. and spread toward conductor terminal (a) 75 kv., (b) 85 kv. With modified stress relief cone, corona starts at 100 kv., (c) 110 kv. and (d) 120 kv.

Shielding

The external shielding is in the form of a conductive glaze fired on the porcelain extending from the curved under surface of the bottom petticoat down to the tapered end of the porcelain, which is solder-sealed to the spun copper wiping sleeve. The upper end of the external shielding is a considerable distance above the end of the internal shielding cone.

Capacitance between the external shield to the cable conductor (the porcelain, the air or gas and the cable insulations being the dielectric mediums) is great enough to allow a considerable amount of the electrostatic flux to be diverted from the internal stress relief cone shielding to the external shielding. This results in reducing the dielectric flux concentration at the end of the internal shielding and effects a considerable increase in the internal dielectric strength in the axial direction along the cable insulation.

Test on the cable unit with modified stress relief cone and incased in an extra long porcelain tube with external shielding gave 60-cycle flashover approximately 60 percent greater than that of the cable unit without the porcelain tube.

Potheads in ratings from 15 kv. to 46 kv. were tested for impulse strength at pressures from 0 to 40 psi. and to over-voltage surges up to 200 percent of the critical flashover values. All flashovers, impulse and 60 cycle, occurred on the outside of the porcelain insulators. For a given size of cable the gas-filled pothead can use a smaller bore porcelain than a compound-filled pothead; because less clearance is required, as no compound is used, the necessity of semi-

How to Get More Life From Worn-out Boilers

If they can pass inspection and a hydrostatic test, APEXIOR will "peg" that condition for more years of good performance.

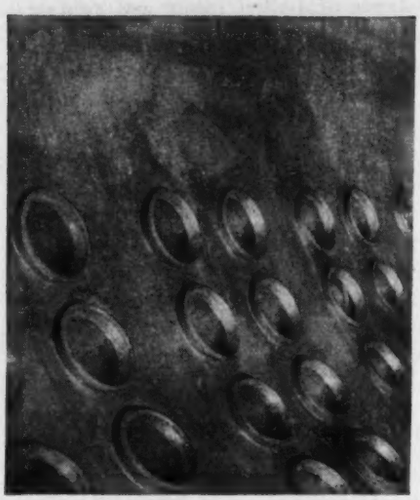
Those boilers nearing the end of their fe . . . those boilers already on the inctive list — there's an excellent chance ou can get more years of work out of em by APEXIORIZING.

Any boiler that can withstand the reuired hydrostatic pressure is good r plenty of hard service — if the test rength of the metal is maintained by durable coating of APEXIOR.

PEXIOR PREVENTS CORROSION FOR 2-3 YEARS

APEXIOR is brush-applied, by hand power-coater. It fills in the metal pores d joints and forms an impenetrable rrier against water. There is less adrent scale, so scale removal is made sy (with a wire brush) . . . and less ten required.

Hundreds of operators have used



APEXIOR for years as an economical means of boiler maintenance. Hundreds more have recently adopted APEXIOR as a guarantee of longer life for metal that cannot be replaced.

An APEXIOR coating will last 2 or 3 years, often longer. It is easily renewed. Save *your* boiler metal from wear and damage that cannot be measured in dollars. APEXIORIZE — and keep boiler metal young.

Easy to Apply — Easy to Maintain — Bulletin 1290 Gives Facts on a Paint that Gives Metal New Life.

ENGINEERING SALES REPRESENTATIVES

Pittsburgh, Cincinnati, New Orleans, San Francisco, Los Angeles, Portland, Seattle, Phoenix, Denver, Salt Lake City, Dallas, Houston, Vancouver, B. C., Montreal, P. Q., Havana, Cuba, Honolulu, T. H., Marine Dept., 114 Liberty St., New York, N. Y.

Users like these have applied APEXIOR for years. APEXIOR will help YOU get more service from irreplaceable equipment.

U. S. Coast Guard
Westinghouse Elec. & Mfg. Co.
Illinois Central Railroad Co.
Standard Oil Co. of N. J.
Bethlehem Steel Co.
Boston Edison Co.
Brooklyn Edison Co.
Carnegie-Illinois Steel Co.
Pacific Gas & Electric Co.
U. S. Navy Department
U. S. War Department
Sun Shipbuilding & Dry Dock Co.

A PEACETIME PLUS · · · A WARTIME MUST

APEXIOR

RECOMMENDED BY ALL U. S. AND CANADIAN BOILER INSURANCE COMPANIES

The **DAMPNEY COMPANY of America**
protective coatings for
STATIONARY BOILERS, LOCOMOTIVES AND STEAMSHIPS

THE DAMPNEY COMPANY OF AMERICA
Hyde Park, Mass.
Please send free Bulletin 1290 to

Name.....

Company.....

Address.....

n Office: **HYDE PARK • BOSTON • MASS.** • *Branch Offices:* **ATLANTA • CHICAGO • NEW YORK • DETROIT • PHILADELPHIA**

stop joints is eliminated. The design principles as developed can be applied to multiple-conductor, gas-filled cable potheads for direct attachment to equipment such as transformers and switchgear.

•

Maintenance Guide for Electrical Controls*

Purpose of maintenance is to prevent the occurrence of trouble in electric equipment. This is best accomplished by preparing a regular maintenance schedule, covering all equipment and following it closely. The following paragraphs from a report of the maintenance committee of the International Association of Electrical Inspectors provides a general guide for the maintenance of electrical control equipment:

Keep Equipment Clean

In dusty locations, clean and blow out all starting switches, compensators, controllers and air circuit breakers at least weekly. Do not allow dust or dirt to accumulate on high-voltage bushings or terminals. Do not permit an accumulation of dirt, oil, grease or water on the operating parts of control equipment. In damp or corrosive atmospheres, paint control parts quarterly or semi-annually. In clean locations semi-annual cleanings will suffice.

Check Mechanical Conditions

The mechanical condition of all control equipment should be checked weekly if subject to vibration or monthly otherwise. Tighten all nuts and screws, examine electrical and mechanical connections on both panels and resistors. Check condition of "pigtail" connections closely—especially in corrosive atmosphere. Replace any damaged or worn parts, and inspect condition of magnet contact surfaces. See that control mechanism operates freely and oil or grease if necessary. Do not lubricate contact surfaces! Check operation of mechanical or electrical interlock devices.

Maintain Contacts

Control equipment subject to severe operating conditions should have contacts inspected weekly. A monthly check is sufficient for average operating conditions. Adjust, file clean, or renew contactor tips if badly worn or burned. (Ordinary roughening of contact tips due to arcing need not be serviced but large projections should be removed with a file. If there is evidence of overheating, oxide surface should be removed by a few strokes with a file.) Examine closely for any high-resistance joints in contactor circuit. (A new combination a.c./d.c. millovoltmeter is available for checking resistance of bolted joints and contact surfaces.) Do not lubricate contact surfaces.

Check Oil Condition

Make semi-annual inspection of oil level and condition in starting compensators, oil switches and circuit breakers. Replace leakage and evaporation loss; replace oil if dirty or gummy. (In dirty or damp locations, inspect oil level and condition quarterly or monthly according to severity of conditions.)

Test Overload Devices

Circuit breaker tripping points should be checked monthly. Replace dashpot oil if thick and gummy. Keep orifices in plunger clear. Keep leather bellows soft and pliable with neatsfoot oil. Be sure that heater coils for thermal overload relays are the correct size. Check overload relay settings every six months.

*This is the second of a series of three articles based on the March, 1943, report of the I.A.E.I. maintenance committee.

•

Meter Tests Check Transformer Loadings

One source of information on loadings of large transformers serving industrial and other heavy loads is the record of routine meter tests. The meter test form usually includes a space where the load at the time of the test is entered. Often that load entry is filed directly in the meter department archives.

However, this is not always the case. In one electric utility the meter test load figure goes direct to the operating department. There it is compared with the record of the transformer installation to see if it indicates under- or over-load. It is checked against readings of transformer temperatures and records of thermal demand meters if these exist for the particular case. If they do not, the meter test load figure may indicate that such checks should be made on loading.

By these various records it is possible to build up and maintain two lists, one of overloaded transformers and one of underloaded, as is done by one operating department head. By consulting these lists he can ascertain in a few minutes where transformers are becoming dangerously overloaded and where to find underloaded ones to replace them.

•

Series Capacitors—Where Place? How Big?

Theory of Operation*—II

By S. LUBIN
Engineer, REA Technical Standards Division

A capacitor placed in series with the line introduces a negative reactance which compensates partially or wholly for the inductive (positive) reactance of the line. The product of load current and the reactance of the line results in a voltage drop which increases as the power factor of the load decreases (lagging) and the series capacitor will thus automatically compensate for this drop. During conditions of leading power factor the series capacitor will "buck" the voltage rise caused by the leading current flowing through the line reactance. The size of the capacitor can be chosen so that its reactance exactly equals the inductive reactance of the line, thereby producing approximately the same effect as though the line contained resistance alone.

If the capacitor is chosen so that its reactance is greater than the reactance of the line between its location and the power source, "overcompensation" of the line reactance occurs, thus balancing out not only the reactive drop or rise of the line between the source and the capacitor, but also all or part of the line resistance drop. In all cases variation of the power factor over the load curve must be taken into account to prevent excessive voltage rise or drop at the capacitor location under certain combinations of load and power factor.

*Second in a series of nine articles which began in the April 17 issue of "Electrical World."

ROCKBESTOS A.V.C. WON'T CRACK IN BLISTERING APPLICATIONS

Why Rockbestos Permanent Insulation Provides Dependable Wire Performance

Rockbestos A.V.C. Power Cable above and similarly insulated Motor Lead Cable (Underwriters' and Nat. Elec. Code, Type AVA) has a maximum operating temperature rating of 110° C. (230° F.) and this permanently insulated construction.

1. A tough, rugged asbestos braid, resistant to heat, flame, moisture, oil, grease and corrosive fumes.
2. Outer felted asbestos wall which serves as a heat-barrier against high ambient temperatures.
3. Lubricated varnished cambric for high dielectric strength and added moisture resistance, protected from heat and flame by two felted asbestos walls.
4. Felted asbestos insulation that withstands conductor-heating overloads and won't burn even when exposed to copper-melting arcs.
5. The conductor is perfectly and permanently centered in helically applied insulation.

One of 122 different wires and cables developed for severe operating conditions.

WON'T bake brittle, bloom, burn or rot — RESISTS moisture, oil, grease and fumes

One of the surest and simplest ways to eliminate wire failures in circuits that run around boilers, soaking pits, furnaces, lehrs, kilns, and other high temperature locations is to wire with *permanently insulated* Rockbestos A.V.C.

Built to withstand severe operating conditions, Rockbestos A.V.C. won't crack, bake brittle, bloom, rot or swell. It resists heat, flame, moisture, oil, grease and corrosive fumes.

Protect your production against interruptions caused by wire failures with Rockbestos A.V.C. wire, cable and cord. 122 *permanently insulated* constructions are available to fit practically every service requirement. Special constructions can be manufactured to meet special applications.

When inquiring or ordering, please give end-use classification and authorized preference rating. For full information, write nearest branch office, or:

Rockbestos Products Corporation, 894 Nicoll St., New Haven, Conn.

ROCKBESTOS A.V.C.

The Wire with Permanent Insulation

NEW YORK, BUFFALO, CLEVELAND, CHICAGO, PITTSBURGH, ST. LOUIS, LOS ANGELES, SAN FRANCISCO, SEATTLE, PORTLAND, ORE.

FOR VICTORY—INVEST IN U. S. WAR BONDS

RELAY TESTING PRACTICE BY WISCONSIN UTILITIES

A summary of practice compiled by Service Operations Committee of Wisconsin Utilities Association

Item	Company							
	A	B	C	D	E	F	G*	H
I. Number of relays in service (approx.):								
(a) Overcurrent, instantaneous	890	64	88	0	0	18	3	0
(b) Overcurrent, induction	1,644	192	729	687	165	86	25	230
(c) Directional, induction	474	72	106	154	49	6	0	30
(d) Differential, transformers	213	15	4	12	15	12	0	15
(e) Differential, generators	48	0	84	30	6	0	0	12
(f) Differential, lines	36	0	7	55	0	18	0	0
(g) Distance, reactances or impedance	3	0	117	117	0	12	0	6
(h) Other types	173	0	92	427 (1)	14 (2)	12	14(3)	...
II. Tests:								
(a) How frequently are routine relay tests made on following equipment (months):								
1. Transmission lines, 132 kv.	6	....	6	6	....	none	none	12
2. Transmission lines, 66 to 26.4 kv.	6	12	6	6	12	6	24	12
3. Transmission lines, 13.2 to 6.6 kv.	6	12	6	12	none	12	24	12
4. Distribution equipment, 6.6 kv. or less	6	12	6	12–24	none	12	24	12
5. Generators	6	none	6	6	none	6	24	12
6. Transformers	6	12	6	6	none	6	24	12
7. Other equipment	12–24	....	6	12–24	none	12	24	12
(b) What type of test facilities are provided?								
1. Test links	yes	yes	....	(4)	yes	partial	yes	....
2. Test switches	yes	yes	yes	(5)	yes	partial	none	yes(7)
3. Draw out type relays	none	none	none	none	none	none	(6)	none
(c) Are the following items inspected during routine tests?								
1. Contacts	yes	yes	yes	yes	yes	yes	yes	yes
2. Magnets	yes	yes	yes	yes	yes	yes	(8)	yes
3. Jewels	yes	yes	no	yes	yes	yes	(8)	yes
(d) Is protected equipment taken out of service during routine tests?	(9)	(9)	(10)	(11)	yes	(9)	(9)	no
(e) Are spare relays used during routine tests?	(12)	no	no	no	no	no	no	no
(f) Are relay connections checked by the relay tester when new equipment is placed in service?	yes	no	no	yes	no	yes	yes	no
If not, by whom?	....	(13)	(14)	(15)	(16)	....	....	(17)
III. Records: Are records of each test kept on file?	yes	yes	yes	yes	no	....	yes	yes
IV. Personnel and Equipment:								
(a) Number of relay testers employed	1 (18)	1	1	1	0	2	2	1
(b) Are testers provided with helpers	no	no	no	no (19)	....	at times	yes	1
(c) Are testers provided with cars	yes	yes	yes	yes (20)	....	yes	yes	yes
(d) Who supervises relay testing	(21)	(13)	(14)	(22)	....	(23)	(13)	(24)
(e) Describe equipment carried by testers	(25)	(26)	(27)	(28)	....	(29)	(30)	(31)

EXPLANATORY NOTES

*All testing done by affiliated company.

(1) Includes plunger type relays, shunt trips and series trips.

(2) Reclosing.

(3) Instantaneous ground relays.

(4) Only where originally supplied before standardizing on test switches.

(5) This is standard and we use Superior.

(6) One set (new).

(7) Superior.

(8) Only when relay gets out of order.

(9) When possible.

(10) In general this is not necessary—one relay is tested at a time.

(11) Not where relay test switches are provided. In other places switches are blocked or taken out of service.

(12) In cases where they are available.

(13) Engineering Department.

(14) Protection Superintendent.

(15) Unless substation engineer does it in his stead.

(16) Installer of new equipment.

(17) Construction foreman.

(18) Plus part time assistance.

(19) Except what help he may request from the district personnel.

(20) A small inclosed truck.

(21) Head station tester.

(22) Substation engineer.

(23) Electrical Engineering Department.

(24) Meter Shop Foreman.

(25) Timer — loading device. Ammeter leads and tools.

(26) Loading transformers, synchronous timer, multi-range ammeter, d.c. voltmeter, tools and leads.

(27) Multi-range ammeters, voltmeter, phase shifter, "Variac" regulating transformer, synchronous timer, load BX, and high current regulating transformer. The test set is of our own design and manufacture.

(28) Our main testing equipment consists of carrying case containing a synchronous timer, a triple scale ammeter, a quadruple scale voltmeter, a slide-wire rheostat with vernier adjustment, a C.T. for higher currents, and the necessary knife blade switches, terminal studs, etc. A resistance load box is used with the testing case for providing necessary loading currents. In addition tester carries portable ammeters (0-0.25 amp.), (0-25 amp.), (0-5-10 amp.), (0-150-300) voltmeter, a phase-angle meter, current transformers for providing large currents thru back-up method, small megger, a combination ohmmeter, ammeter, voltmeter for a.c. and d.c., necessary repair parts, tools, safety appliances (gloves, blankets, sleeves, etc.), and many other items too numerous to mention.

(29) Tools, parts, jewels and bearings, load box, slide wire rheostat, ammeter, voltmeter, cycle-counter.

(30) Cycle counter (West.), 1 (5-10 amp.) ammeter, 1 (15-30 amp.) ammeter, set of cords and resistors to get current up to 60 amp. Ordinary meter tester's tools.

(31) Special relay test table, loading equipment, cycle counter, phase meter, wattmeter, voltmeter, ammeter.

These Two, and You

When you reach home from work tonight,
Two such as these, may greet your sight.
Still, maybe yours are older now,
And prints of time may mark her brow.
Which e'er it is, you still would give
Your very life that they might live.
And need we now enumerate
Those unknown trials that may await?

But there is one thing you can do,
For them, for self, and Country, too—
That is, Buy Bonds—to put away
For what may be their rainy day.
Buy Bonds, for those nice things you've planned—
Buy Bonds, and you'll be feeling grand!
Buy Bonds, for those who'll greet your sight,
When you reach home from work tonight.

Buy Bonds, for those who fight YOUR fight!

Chromel
NICKEL CHROMIUM
HOSKINS
CHROMEL
ELECTRICAL HEATING ELEMENT
WIRE

HOSKINS MANUFACTURING COMPANY
DETROIT, MICHIGAN

1¼ MINUTES READING TIME

OSMOPLASTIC

PROTECTS YOUR POLES FROM GROUNDLINE DECAY

Here's How:

1 Dig earth from around pole to a depth of about 14 inches from groundline. Then remove loose decayed wood in the treatable zone.

2 Apply OSMOPLASTIC by brushing or daubing on the cleaned surface from 6 inches above to 12 inches below the groundline level.

3 Wrap Osmose bandage around treated area. This protects and retains the Osmoplastic until the Osmosalts penetrate into pole.

4 Back-fill the hole and the operation is completed. The Osmoplastic protection adds many extra years service to standing poles.

Osmose Wood Preserving Company of America, Inc. Dept. W
1437 Bailey Avenue, Buffalo, N. Y.

Please send me the new Osmoplastic Bulletin on groundline treating utility poles for *extra* years of service life.

Name_____

Address_____

City and State_____

OSMOSE
WOOD PRESERVING
COMPANY of AMERICA, Inc.
BUFFALO, N. Y.
DENVER CHICAGO NEW YORK
KENOVA, W. VA.

Welding Simplifies Repair of Economize

An emergency repair by arc w ing of an economizer tube reduce 22 hours the shutdown time of a h pressure boiler in a plant of Con dated Gas, Electric Light & P Company, Baltimore, Md., accor to R. C. Fitzgerald, a welding e neer of the utility company. boiler shutdown was necessitated a faulty tube in an economizer ment developing a leak. Fortunat the leak occurred at the end of economizer, where it was easily a able for repair.

Repair of the unit was made chipping out the crack and wel with a mild electrode. Total time this repair job did not exceed

ECONOMIZER TUBE has been ch out and is ready for welding

hour, and the cost in man-hours approximately $2.30.

The leak could have been we by another method. It would been necessary to cut off the ec mizer at both the inspection and exit headers and weld blanks int stud ends. This alternative re would have eliminated the leak the margin of extra capacity in economizer would have been red in addition to destroying an ec mizer unit. To cut and repair wel stub ends at the headers would required the boiler to be shut d an additional day.

Comparison of costs of the tw pair methods follows:

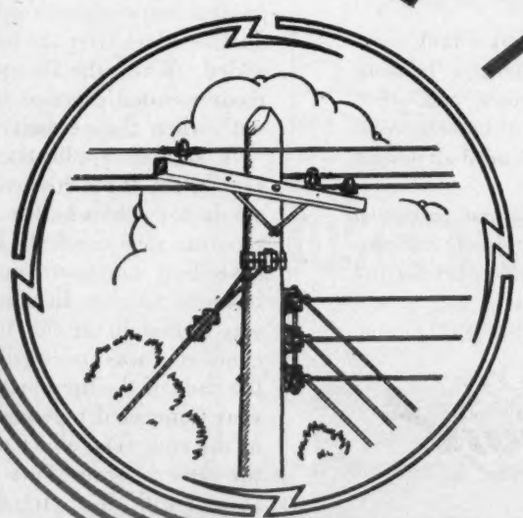
Cost of Welded Repair—L cost, $2.30; shutdown cost of b

* Adapted from paper submitted in cont award by the James F. Lincoln Arc W Foundation.

JUST OFF THE PRESS

Seyler

POLE LINE HARDWARE AND CONSTRUCTION SPECIALTIES CATALOG No. 43



SEYLER MANUFACTURING COMPANY
BOX 7827, SHARPSBURG. P.O. PITTSBURGH, PA.

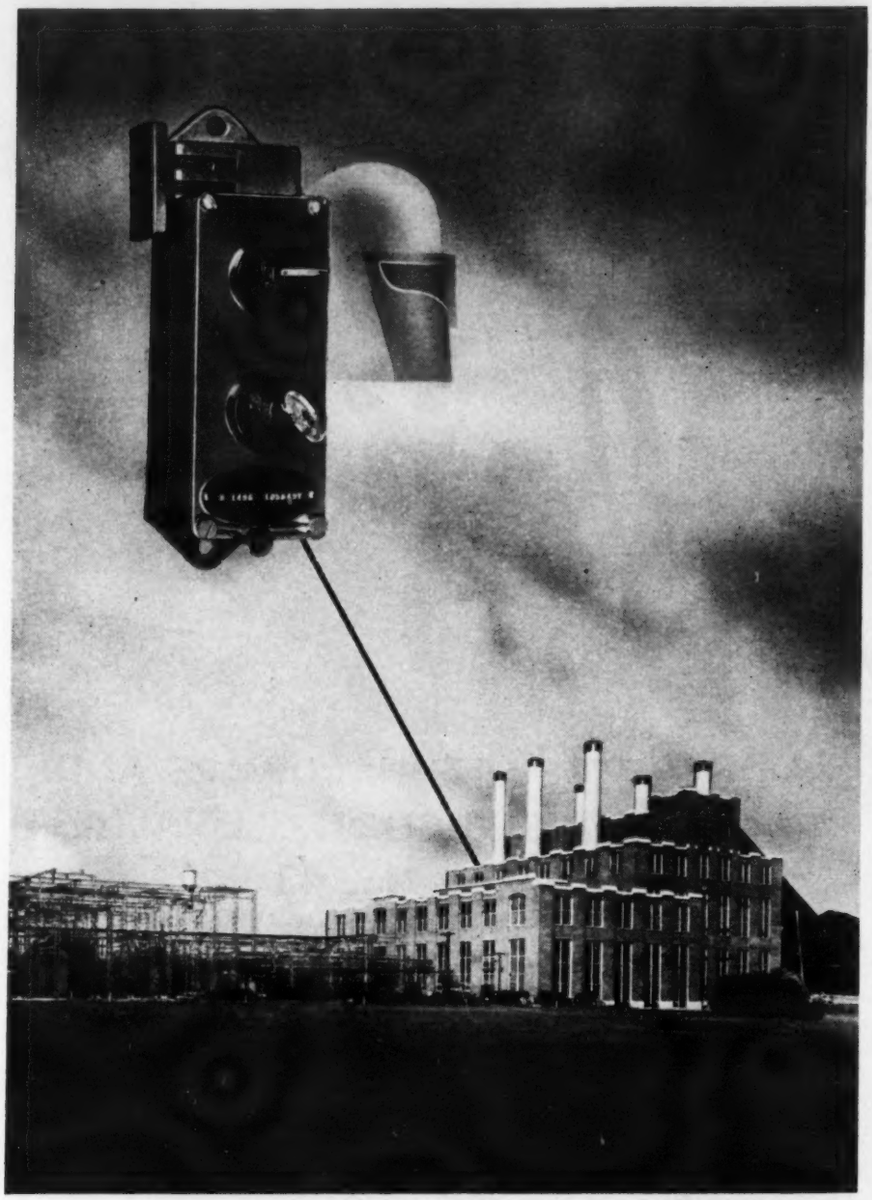
Please send me your Catalog No 43.

Name.....

Firm.....Title.....

Address.....

City.....State.....



SAFETY MAN of "The Invisible Crew"

AMONG the members of the famous Bendix "Invisible Crew" is a device developed especially for the power plant. It is the "BENDIX-CORY" INTERLOCK . . . a simple, tamper-proof mechanism that safeguards both men *and* equipment.

By means of this rugged, precision-built interlocking device you can prevent access to *any dangerous place.* Bus and oil circuit breaker tank compartments, cell structures housing high tension conductors, and other dangerous equipment become *completely inaccessible* . . . until all danger has been removed.

This system of *proved protection* can be employed both inside and outside your plant. Write today for full information. Address:

The "BENDIX-CORY" INTERLOCK is a member of "The Invisible Crew"—precision equipment which 25 Bendix plants Coast to Coast are speeding to world battle fronts.

THE INVISIBLE CREW
Precision Equipment by Bendix
AVIATION CORPORATION

BENDIX MARINE DIVISION - One Hanson Place, Brooklyn, New York

for 38 hours, $828; total cost $830.30.

Cost of Alternative Method (estimated on the basis of experience with similar jobs in the past)—Labor cost $18.40; shutdown cost of boiler for 60 hours, $1,386; replacement value economizer unit, $295; total cost $1,699.40.

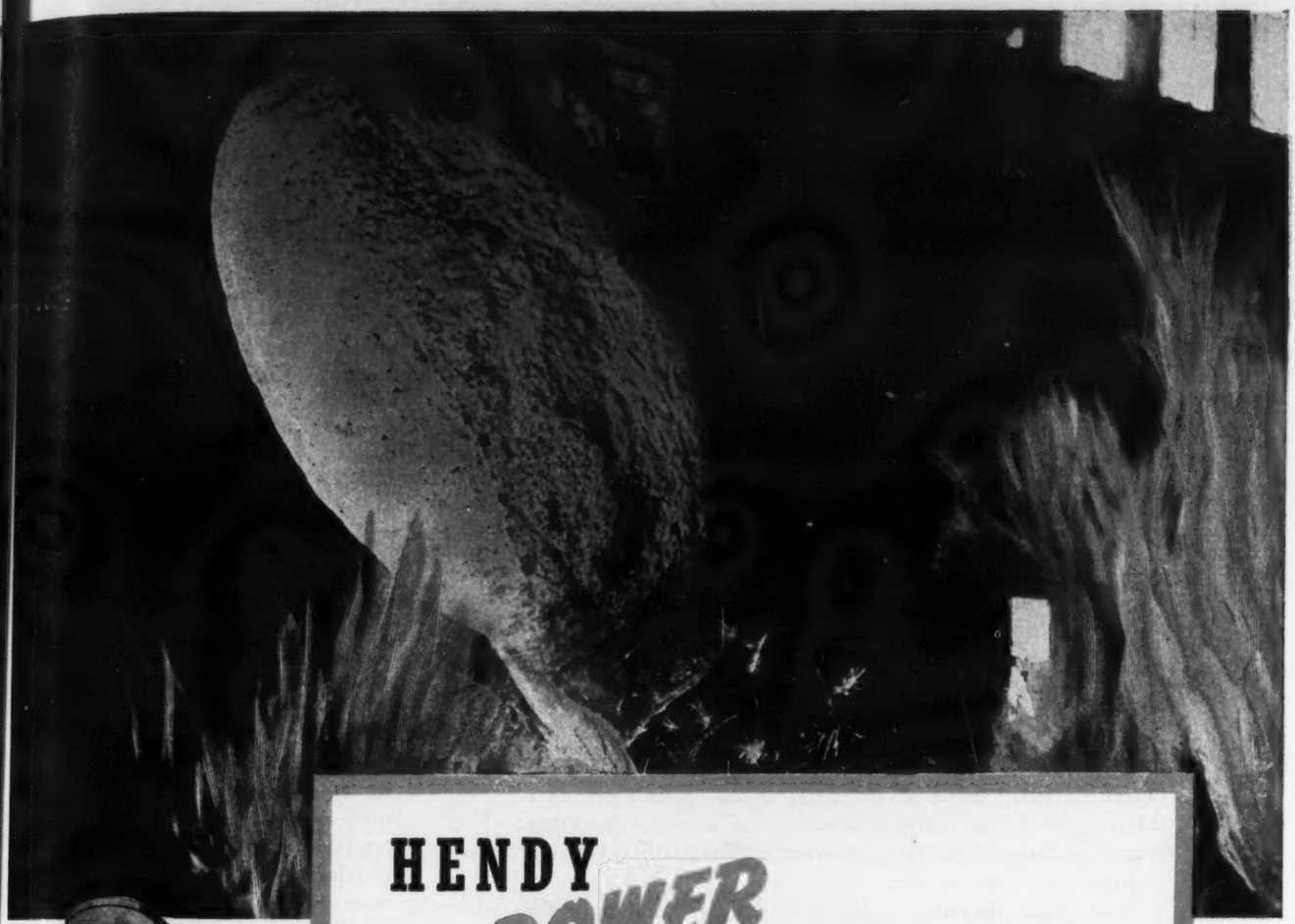
Magnetic Heat Neutralized

BY C. O. VON DANNENBERG
Brooklyn, New York

There appeared in the ELECTRICAL WORLD issue of March 20, 1943, an article concerning the "Effect of Magnetic Heating on Cables." The writer some years ago experienced a situation where mitigating steps were taken to prevent injurious effects of a similar nature which may be of general interest.

It was necessary to carry for some distance three 500,000-cir.mil single-conductor cables supported by clamps with split porcelain bushings; these were of the conventional type with malleable iron base and clamp and iron bolts. Since the current was a.c. 60 cycles and exceeded 300 amp., considerable local heating occurred at each clamp. Since non-ferrous bolts or clamps were not available and breaking the magnetic loop was not feasible, the expedient of placing a short-circuited insulated copper loop around each clamp was adopted, and it solved the situation. Each loop consisted of a piece of $\frac{1}{32}$-in. thick copper, $\frac{1}{2}$ in. wide, bent to fit the clamp, soldered at the end and dipped in insulating paint. So far as could be judged there was no appreciable inductive effect after the loops had been added. While the foregoing is not a recommended practice, it is one "way out" when the necessity arises.

A similar application was necessary when three high-voltage single-conductor cables had to be carried in separate steel conduits for a distance exceeding one-fourth mile. In this instance another insulated conductor was pulled in at the time the main conductor was installed in each duct; the ends of the three extra conductors were connected together at both ends of the run. The effect was essentially the same as occurs in a current transformer with short-circuited secondary and in the application referred to the

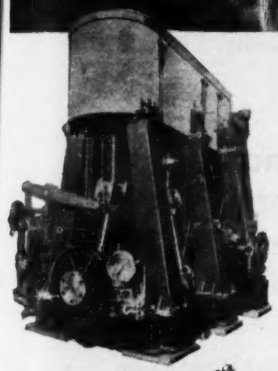


HENDY *POWER* for the Bridge-of-Ships

Spanning the oceans between production and fighting fronts are mighty flotillas of Liberty Ships . . . the floating bridges for men and munitions...now mass produced on a scale formerly believed impossible.

More than one-third of these vessels are powered with dependable Hendy steam engines . . . the same type of Hendy power plants that carried Yanks to France in 1918. Today, however, the Iron Men of Hendy turn out as many engines in 11 days as they built in two years of World War I.

If Joshua Hendy could see what has been accomplished since 1856 . . . how the Hendy nameplate has become the distinguishing mark of dependable POWER . . . if he could look over the shoulders of Hendy engineers and see their plans for the future . . . he would take justifiable pride in his vision that POWER wins wars and insures peace.



THE IRON MEN OF **HENDY** . . .

. . . now, for the first time in history, build marine steam engines by mass production, assembly line methods These engines stand two-and-one-half stories high and weigh 274,000 pounds.

JOSHUA HENDY IRON WORKS

HOME OFFICE

Sunnyvale, California

ESTABLISHED 1856

DIVISIONS: *Crocker-Wheeler Electric Manufacturing Company; Pomona Pump Company*

HENDY

MANUFACTURING PLANTS: SUNNYVALE, LONG BEACH, POMONA AND TORRANCE, CALIFORNIA; AMPERE, NEW JERSEY; ST. LOUIS, MISSOURI
BRANCH OFFICES: NEW YORK, WASHINGTON, PHILADELPHIA, PITTSBURGH, CHICAGO, ST. LOUIS, SAN FRANCISCO, LOS ANGELES

RE-LIGHTING

the new manpower / production *requirement*

OPERATION STUDY SHEET

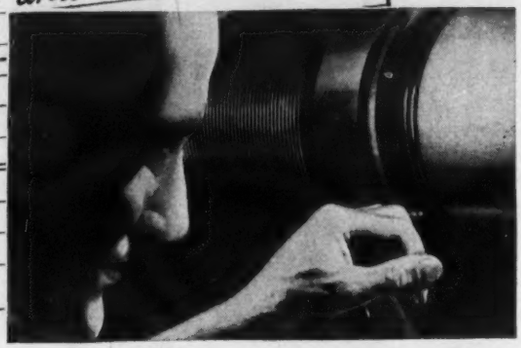
Working Conditions *Poor light, caused by improperly located lamps. Heavy shadows on work area confuse and slow up worker... considerable spoilage--accident hazard.*

Machine No. *349*

Capacity

Size

Department



Vital to reduce rejects, increase production

Operation study sheets all too often record "poor light" as a major cause of poor quality production—of too many units that cannot pass inspection. This condition is particularly noticeable on night-shift work because—

Most plants operating today were designed and built for peacetime, *daylight* working schedules. Wartime production demands night work; and *lighting based on daylight conditions is inadequate to serve the needs of night workers.*

The answer to this problem is *re-lighting.* You can quickly, easily, and with little expense increase the efficiency of your present lighting equipment by re-locating lamps to eliminate glare and shadow, increasing lamp wattages where necessary, or installing additional equipment to insure uniform lighting levels throughout your plant. A Silv-A-King lighting engineer can tell you exactly what is necessary.

Silv-A-King has specialized in industrial lighting for 22 years. Silv-A-King quality equipment (fluorescent or incandescent) plus a Silv-A-King "engineered layout" makes an unbeatable combination.

BRIGHT LIGHT REFLECTOR COMPANY, INC.
1035 Metropolitan Avenue, Brooklyn, N.Y.

Send for your copy of our 16-page book: "Light Is An Essential Production Tool"

SILV-A-KING

MAKES *Light* WORK FOR YOU

BROILKING AFTER THE WAR, MORE THAN EVER *America's Finest Electric Table Broiler*
INTERNATIONAL APPLIANCE CORPORATION
1027 Metropolitan Avenue, Brooklyn, N. Y.

neutralization of the inductive effect was quite complete; no appreciable heating of the conduit was noticeable. Three three-conductor cables could have been installed, one in each conduit, but the availability of the single-conductor cable made the method as followed desirable for an immediate result.

A test was made, as an experiment to convince skeptics, by passing a current of some 50 amp. through pieces of conduit 18 in. long, one with and one without the short-circuited loop. In a relatively short period the conduit without the short-circuited loop became unbearably hot.

Local heating when high a.c. currents are carried occurs at unexpected places. Three fibre conduits, each carrying two 800,000-cir.mil insulated cables, were mounted on a wood block support, each conduit being held in place by a 1-in. galvanized iron strap held to the block by wood screws. There was no closed magnetic circuit. The three straps were separated at their ends by at least 2 in. In spite of this the straps became quite warm; the current per conduit was approximately 1,300 amp. For a later installation straps of brass were used, which seemed to solve the heating difficulty.

•

Performance of △ — △ Transformer Banks*

II—Three-phase Load

By ROBERT S. SARGENT
Associate Engineer,
U. S. Engineering Office, Jacksonville, Fla.

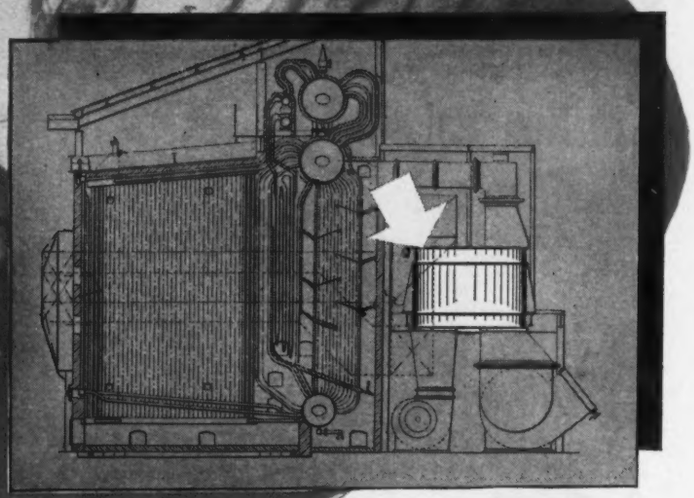
A balanced three-phase load on a delta-delta bank behaves in a somewhat more complex manner than a single-phase load, but analysis is simplified if the load is considered to consist of three equal single-phase loads, one across each phase. Each of these single-phase loads will divide in accordance with the impedances of the parallel paths, so that, in each winding, the resultant current will consist of three component currents, of varying sizes and phase angles, which must be combined vectorially.

The load on the middle and wing transformers may be expressed as follows:

Load on middle transformer equals the three-phase load divided by three multiplied

*Previous installment appeared in the April 17, 1943, issue of "Electrical World."

BOOSTING THE OUTPUT for meat packing plants



Ljungstrom Air Preheaters help mid-western central station fill packers' power and steam demands

During 1942, two of these Ljungstrom-equipped steam generating units were on the line 97% of the time . . . and their availability was over 98%. Fired by natural gas, each unit has a continuous capacity of 200,000 lb. steam per hr. Flue gases enter the preheater at 700° F., leave at 350° F., heating incoming air to 560° F., as an aid to efficient combustion. Heat recovery in the preheater is a significant factor in holding efficiency at 82.9%, which meets the design estimate for natural gas firing.

. . . . .

Food packing plants...synthetic rubber plants... munitions manufacture . . . wherever the war is forcing steam generation to the limit, Ljungstrom Air Preheaters are establishing highly favorable records of practical, full-time performance.

These *service* advantages are over and above the initial *engineering* advantages of the Ljungstrom: its saving of steel, its conservation of space, and the extra efficiency of its *continuance regenerative counterflow* principle.

These highly flexible gas-to-air heat transfer units are now finding application in many processing operations outside the field of steam generation, as on oil heating furnaces. For facts and figures, write:

THE

AIR PREHEATER

CORPORATION

Executive Offices: 60 East 42nd Street, New York, N. Y. • Plant: Wellsville, New York

"Skilled" Lighting

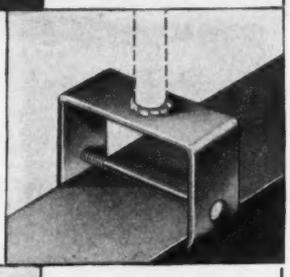
FOLLOWS THROUGH with RLM Non-Metallic Reflectors!

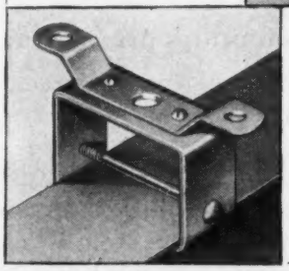
Reflecting surfaces of chip-proof, washable baked enamel have an enduring reflection factor of not less than 84% . . . minimum overall efficiency of 80% in 48" 2-lamp units, 73% in 3-lamp units and 73% in 60" 2-lamp units.

ADAPTABLE SUSPENSION

"C-clamp" slide hanger with cable clamp

"C-ciamp" slide hanger for conduit mounting





"C-clamp" slide hanger for close-to-ceiling mounting

With metal at a premium . . . you can still have the advantages of "Skilled Lighting"! Wheeler engineers . . . lighting specialists with over 61 years' experience . . . have developed fixtures with non-metallic reflectors that meet all requirements of wartime industry for efficient fluorescent lighting.

Wheeler "War-Aid" Reflectors fulfill high standards of construction as well as illumination. Nonflammable, moisture-resistant, rugged . . . equipped with special features that simplify installation and maintenance. In every way now practical, they're typical Wheeler "Skilled Lighting!"

Write for new bulletin No. 71 on Wheeler "War-Aid" Fixtures and catalog of Wheeler Incandescent Fixtures. **Wheeler Reflector Company, 275 Congress St., Boston, Massachusetts** . . . New York . . . Cleveland. Representatives in principal cities.

Distributed Exclusively Through Electrical Wholesalers

Wheeler REFLECTOR COMPANY

Lighting Equipment Specialists Since 1881

by $1\frac{1}{2}\left(1 - \frac{B}{2A+B}\right)$ and the load on each wing transformer equals the three-phase load divided by three multiplied by

$$\frac{1.73\sqrt{A^2 + AB + B^2}}{2A + B}$$

A and B representing the kva. capacities of the middle transformer and one wing transformer, respectively.

The following conclusions may be drawn:

1. If the three transformers are equal in size, the coefficient in each case reduces to unity and each transformer will carry one-third of the load.

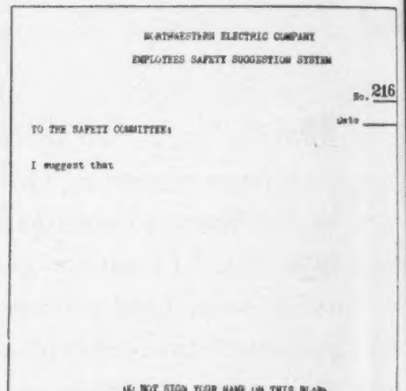
2. As the middle transformer is made larger, it will assume a larger portion of the load, but in no case will it ever carry more than one-half the total three-phase load.

3. As the two wing transformers become relatively smaller, they will carry less and less load, but in no case will a wing transformer ever carry less than one-third the total three-phase load times 0.866, or 28.8 percent of the total three-phase load.

Discussion of the combined single and three-phase load will be presented in a subsequent issue.

•

Monthly Safety Suggestion System



NORTHWESTERN ELECTRIC COMPANY
EMPLOYEES SAFETY SUGGESTION SYSTEM

No. 216

Date _____

TO THE SAFETY COMMITTEE:

I suggest that

DO NOT SIGN YOUR NAME ON THIS BLANK

(Retain this stub)
NORTHWESTERN ELECTRIC COMPANY
EMPLOYEES SAFETY SUGGESTION SYSTEM

Stub No. 216

An employees-safety suggestion system has been inaugurated by the Northwestern Electric Company, Portland, Ore., with cash prizes of $5, $3 and $2 awarded each month to the best three suggestions in order of merit. All suggestions are reviewed at the regular monthly meetings of the safety committee of the company, which awards the prizes by majority vote.

Suggestions are sent in on blank forms provided for the purpose, one suggestion to a blank, but there is no

MELMAC ARC-RESISTANT "ARMOR"

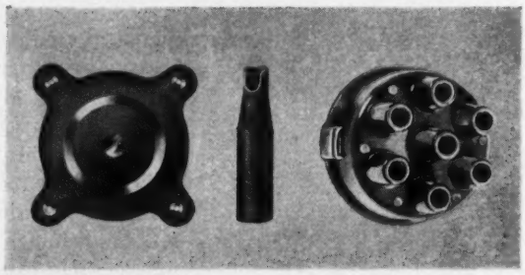
FOR NEW DIELECTRIC NEEDS!

If you are seeking a new insulating material it will pay you to investigate Melmac*—the new, tough, thermosetting plastic that offers an unusual combination of electrical and physical properties to meet new wartime needs.

For example, Melmac #592 (Mineral filled) has a dielectric strength of 450 Volts/Mil; arc resistance of (ASTM) average: 130 sec.; high heat resistance, and excellent dimensional stability in a wide temperature range.

Electrical parts and housings are being produced with speed and efficiency by conventional molding methods. Screw inserts and contact points are integrally incorporated in the molding operation—eliminating extra steps and speeding assemblies.

Investigate this new material for your dielectric needs. Several types are available to meet various technical and service requirements. Your inquiry about adapting Melmac for *your* needs will receive our prompt attention. Sample pieces on which to perform your own tests will be supplied on request.



Aircraft ignition assembly and harness parts, molded of Melmac, show the adaptability of this plastic to today's demands. Because of Melmac's importance in the war effort, its commercial use is restricted to essential applications but samples for research and testing may be obtained without a specific priority rating.

AMERICAN CYANAMID COMPANY
PLASTICS DIVISION
34 ROCKEFELLER PLAZA, NEW YORK, N. Y.

BEETLE • MELMAC
CYANAMID PLASTICS

WITH EASY-FLO

EASY-FLO—the low temperature silver brazing alloy—is now virtually standard on marine construction for joining terminal tubes to switch boxes, lighting fixtures and other terminal boxes. It provides everything the job calls for—speed, reliability and low cost in making high strength, water-tight joints that have the ductility to stand up under the severe vibration and shock of heavy gun fire.

The job is done by preplacing a ring of Easy-Flo wire in the joint assembly as illustrated. This preplacing of the alloy is an important factor in the fast production obtained and also gives close control of the amount of alloy used.

Easy-Flo rings are available for all standard terminal tube sizes.

NEW EASY-FLO "RINGS" BULLETIN

ARMY NAVY 1st AWARD August 1942 2nd AWARD February 1943

It explains the brazing procedure fully and tells the ring size required for different sizes of terminal tubes. Write for a copy of this new Easy-Flo "Rings" Bulletin today.

HANDY & HARMAN

HANDY & HARMAN FOUNDED 1867 QUALITY SERVICE

82 Fulton St.
New York, N. Y.

Agents in Principal Cities
HANDY & HARMAN of Canada, Ltd., Toronto

limit on the number of suggestions submitted by any one person. The suggester is not to sign his name, however. Each blank has an identification stub, the blank and stub being given the same serial number. He tears off the stub and keeps it for identification later. Each month after the prizes are awarded the three winning numbers are posted on all bulletin boards of the company. The suggestions should be dated, since in case of duplicate suggestions the one bearing the earliest date gets the corresponding prize.

Suggestions are limited to topics concerning the prevention of accidents to employees or the general public, where either may have occasion to be around company property or equipment, and to those bearing on fire hazards on company property.

All employees are eligible except general officers and assistants, superintendents and assistant superintendents. Foremen may be eligible for awards only for suggestions relating to work practices, equipment or tools not under their own supervision. Likewise, members of the safety committee are eligible for awards for suggestions pertaining to practices, equipment and tools in departments other than the one in which they are employed.

•

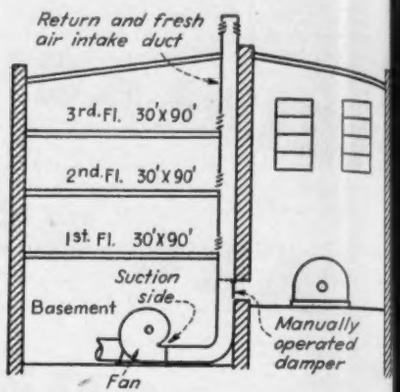
Substation Losses Heat Company Office

Warm air discharged by large electric motor-generators operating in a substation in an adjacent building of the Savannah Electric & Power Company heats the main office building.

Several years ago the company's three-story main office building was air conditioned and a fuel oil burning heating plant installed. Recently the fuel-oil conservation campaign prompted study as to how the heating plant might be so converted, and J. G. Brown, electrical engineer, conceived the idea of using the heated air from the motor-generators next door.

Only a brick wall separates the substation from the office building and the intake duct of the conditioning system, reaching from the roof to the basement, runs down this wall. A hole was cut through the wall and the intake duct pierced a few feet from its lower end. A manually operated damper was installed which when raised, closes the intake duct from the roof and opens the new vent leading into the substation. The air conditioning plant fan draws the warm air from the substation, passes it through the conditioning machine and discharges it to the three floors of the office building, each of which is 30 by 90 ft.

The unattended substation comprises two synchronous motor-generator sets of 750 and 500 kw. respectively, operated alternately. About 6,000 cu.ft. per minute of 90 deg. air is now being drawn from the substation. Until the conversion this air was discharged constantly into a back alley by a large exhaust fan, fresh air being drawn in through ventilators at the other end of the station. This fan is still operated to draw off the warm air at such times as it is not being used by the conditioning system, thus assuring the motor-generators the necessary air for cooling purposes at all times.



CONVERSION SETS in adjoining substation provide heat for office building and save 90 percent of former fuel oil

Temperature in the office building is controlled by the manipulation of the manually operated damper, while the exhaust fan in the substation is remotely controlled from the power plant, several city blocks distant. When the warm air from the substation is cut off from the conditioning machine the power plant is telephoned to start the exhaust fan in the substation, thus assuring full protection of cold air to the motor-generators.

Cost was negligible, but the saving in fuel oil is practically 90 percent; it has been necessary to operate the fuel-oil burner only for periods of two or three hours in the morning of the coldest days.

The 8200 Series

For all generally used ground wire cables.

This drop forged trunnion type ground wire suspension clamp combines strength and adequate cable-supporting length with lightness and smooth contact surface. The integrally forged U-Bolt Keeper on which the supporting bail is factory assembled results in a minimum of loose parts and simplicity of field application.

Why not get the full story on BTC clamps. Your copy of our Hi-Line reference book on request.

Through Your Insulator Manufacturer Only

BTC

Drop Forged Hi-Line Hardware

THE BREWER-TITCHENER CORPORATION
CORTLAND, NEW YORK

LOAD SERVICING

Industrial • Commercial • Rural • Residential

Farm Dehydrator Uses Electric Heat

Built entirely from non-priority materials, the forced-draft dehydrator shown was developed for farm use for the preservation of perishable fruits and vegetables by drying. The design uses nine 100-watt lamps to heat the air used for drying and affords a desirable new use for electricity on the farm, which is in line with the government's wartime food conservation program. This dehydrator is a development of the agricultural engineering department of the University of Illinois at Urbana and is intended for drying such produce as sweet corn, lima beans, garden peas, beans, pumpkins, apples, peaches, and the like.

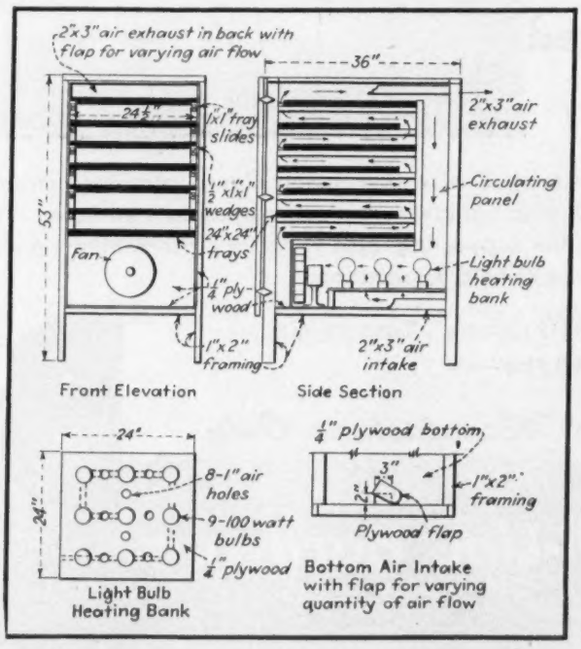
Cabinet of the dehydrator contains seven 2 x 2-ft. trays on which products to be dried are spread. Hot dry air is forced freely and uniformly through and around the trays by a fan. Provision is made for recirculating the air, for drawing in fresh air and for exhausting the warm moist air from the cabinet.

Lamps that warm the air used for drying are mounted in a plywood base in the bottom of the cabinet. Holes are cut in the base to permit air to be drawn through the lower vent in the bottom of the dryer and thence through base past the heated lamps. The vent is adjustable for heat and humidity control. A fan in front of the lamp bank forces the air through the dryer chamber, back and forth across the trays and exhausts it through the top vent. The remainder is drawn down between the back wall and the baffle board to be mixed and reheated with the incoming fresh air before being recirculated.

Seven trays, each 2 ft. square and spaced 3 in. apart, are accommodated in the cabinet. Trays are made of a 1-in. frame to which ½-in. hardware cloth is attached. The inside of the compartment is slightly more than 24 in. wide and 27 in. long to provide a 3-in. space through which air is forced by a fan. Trays are staggered to form a baffled path that will force the air over the surface of the trays through them to speed drying.

Drying temperatures up to 150 deg. are satisfactory for most fruits and vegetables. Control is obtained by adjusting the vent openings or by turning off part of the lamps. While thermostat control of temperatures will insure a more uniform product, it is not essential. A thermometer in the lowest tray will register the highest temperature in the cabinet.

A loading of about 1 lb. per square foot has been found to give good results. Tests with the cabinet used for drying sweet corn show that 31.5 lb. of corn with a moisture content of 75.2 percent was dried in 24 hours to a weight of 8 lb. 6 oz. and a moisture content of 10.8 percent with an energy consumption of 20 kw.-hr., or about 2½ kw.-hr. per lb. In another instance 35¼ lb. of sweet corn slightly more mature and less moist than the above was dried in 23 hours 15 minutes to 10.7 percent moisture and a weight of 12 lb. 8 oz. with an energy consumption of 19.4 kw.-hr., or about 1½ kw.-hr. per lb. of dried product.



DEHYDRATOR for drying farm produce uses 1½-2½ kw-hr. per pound; nine 100-watt lamps provide heat for drying vegetables and fruits

•

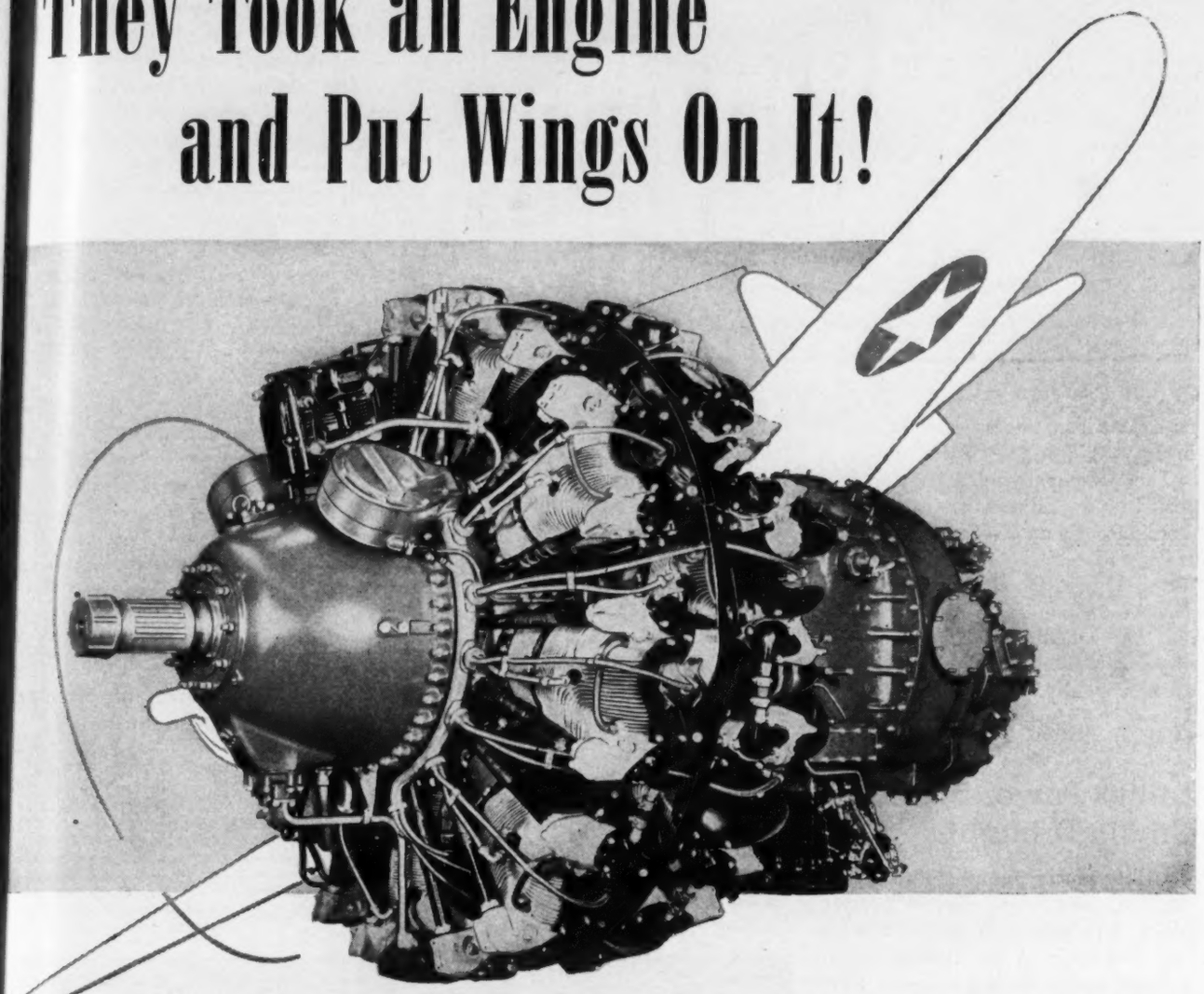
Cooking Schedules Cut Load, Cost

The Nebraska Power Company, Omaha, as a service to its commercial cooking customers, is showing business establishments and institutions that use electricity for cooking and baking how to reduce their demand and total net bill through carefully scheduled use of electric cooking and baking appliances.

Rules suggested for the economical operation of electric kitchens are: (1) Keep load demand down; (2) use automatic controls wherever possible; (3) turn switches to "low" when equipment is idle; (4) use no more heat than necessary; (5) use stored heat in the equipment, and (6) use specialized equipment to eliminate as much surface cooking as possible.

It is pointed out in applying these rules that cooking schedules should be set up so that only necessary equipment is turned on at "high" at the same time. For example, the surface of the range used for preparing breakfast and starting dinner can be heated to "high" before other equipment is turned out. Thus, when the oven is turned on for roasting, surface heating units can be turned to "low" or "medium" to cook breakfast. Then when ovens have reached the required temperature, the oven controls can be set. Before turning on fry kettles and broilers for preparing lunch, the ovens can be turned off and operated

They Took an Engine and Put Wings On It!



YOU are looking at a closeup of one of the world's mightiest naval aircraft engines—the great 2,000 H.P. Pratt & Whitney Double Wasp!

Heart of the Navy's pride—the carrier-based *Corsair* fighter—this engineering masterpiece is built by Nash-Kelvinator!

Around this mighty power plant the engineers of Chance Vought designed a fuselage—added just enough flight surface to give it a grip on the sky—and thus they produced the fastest-flying, fastest-climbing, carrier-based plane in the world! Literally little more than an engine with wings and a battery of blazing guns!

With eighteen radial, air-cooled cylinders, a high-altitude supercharger, and more than 10,000 separate parts, this great flying engine, built by Nash-Kelvinator, is a miracle of precision workmanship!

Yes, this is Kelvinator's wartime model—and we are proud to be entrusted with the production of war models like these. And we are proud, too, that the Kelvinator tradition of precision workmanship is now being recognized on the far-flung battlefronts of the air, as it is in the homes of America.

• • •

It is significant that the Kelvinator Polarsphere Sealed Unit—which we believe is the most trouble-free refrigerator unit in the homes of America today—was built to the same exacting standards required in the production of this mighty Corsair engine.

SCRAP IS POWER

Cooperate With Your Industry! Salvage All Inoperative Parts Containing Critical Materials . . . Put Vitally-Needed Scrap Back Into the Scrap TODAY!

LOOK AHEAD WITH *KELVINATOR*

DIVISION OF NASH-KELVINATOR CORPORATION, DETROIT, MICHIGAN

Operating Schedule for Commercial Electric Kitchen Equipment

	Time (A. M.)								Time (P. M.)							
	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8
Ranges	H	H-M	M	M	M	M	L	L	L	L	L-O	H-M	M	M	L	O
Roasting ovens	O	O	H	H	A	A	A	O	O	O	O	O	O	O	O	O
Fry kettles	O	O	O	O	H	A	A	A	A	A	O	H	A	A	A	O
Broilers	O	O	O	O	O	H	H	H	H	M	L	M	H	H	H	O
*Bakeovens	A	O	O	O	O	O	O	O	O	O	O	O	O	O	O	H
Stock kettles (minor)	H	H	H-L	L	L	L	L	L	L	L	L	L	L	L	L	O
Coffee urns	H	H	L	L	L	L	H	L	L	L	L	L	H	L	L	O
Griddles	O	H	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Waffle bakers	O	H	A	A	A	A	A	A	A	A	A	A	A	A	A	A
Egg boilers	H	L	L	L	L	L	O	O	O	O	O	O	O	O	O	O
Toasters	O	H	H	H	H	L	L	L	L	L	O	O	H	H	L	O
Steam tables	O	O	O	O	O	H	L	L	L	L	O	O	H	L	L	O
Bain Maries	H	M	M	M	M	L	L	L	L	L	O	H	H	L	L	O

H — Switches on high; M — Switches on medium; L — Switches on low; A — Devices operating automatically; O — Switches off.
* Bakeovens operating at night. Start to preheat at 8 p.m. ready for baking at 10:30 p.m. Off at 6 a.m., baking in stored heat until 8 a.m.

on stored heat to complete the roasting.

The accompanying schedule, suggested by the Edison General Electric Appliance Company for efficient operation of a kitchen, is being recommended by the Omaha company to assist its commercial cooking customers. The schedule is based on commercial food establishments serving 16 hours daily.

•

Utility Power Serves City in Drought

Utility power pumped 704,390,000 gal. of water into the Worcester, Mass., city system from the Wachusett Reservoir of the Boston metropolitan supply during a recent four-month low water period at a total cost for electricity of $33.50 per million gallons. The total energy consumption was 1,875,300 kw.-hr., and the average cost to the city was about 1.25 cents per kw.-hr. The town of West Boylston's municipal lighting department, which purchases energy from the New England Power Company, sold it to the city of Worcester at a pumping station located at the reservoir, the water being delivered to the Worcester system at Summit through a 30-in. main.

This pumping station originally contained three 1,400-g.p.m. belt-driven pumps of pre-war vintage, each having a 250-hp., 440-volt induction motor. These were designed for a head of 577 ft. To meet the emergency conditions of water supply, two new direct-driven pumps were installed, each being a 1,750-g.p.m. Dayton-Dowd centrifugal pump run by a 300-hp., 2,200-volt induction motor at 1,750 r.p.m., the designed head being 530 ft. The older pumps were maintained for service with the later units, although in general one of the former was not used when the new equipment was in operation.

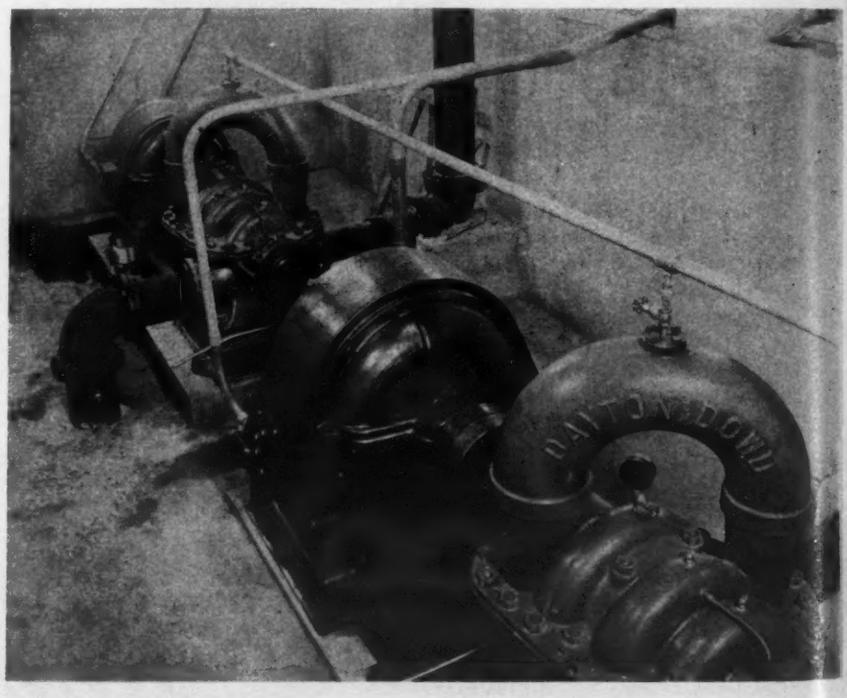
The passing of the low-water period enabled the equipment to be shut down, and the city supplied from its own reservoirs, but the connection and pumping facilities, as well as their immediate readiness for service, are of great value to Worcester, which now has a population of nearly 200,000. A summary of the four-month operations is given, with a typical bill for the month of maximum demand, 956 kw. Although such a pumping station is a reserve installation, the supply of electricity to it is an important public service whose total cost to the city for the period, $23,518.90, represented insurance against a more serious shortage during a drought which required substantial economies in the use of water.

Table I—Typical Monthly Billing for Pumping Power in Drought

Demand — 956 kw.	
Demand Charge,	
200 kw. at $2.75 per kw.	$550.00
756 kw. at $1.25 per kw.	945.00
Total demand charge	$1,495.00
Energy Charge	
Total energy consumed — 657,100 kw.-hr.	
200 kw.-hr. x 956 at $0.0105	$2,007.60
465,900 kw.-hr. at 0.0085	3,960.15
Fuel Charge	
657,100 kw.-hr. at 0.00146	959.37
Total energy and fuel charge	$6,927.12
Total cost of service	$8,422.12
Discount at $0.001 per kw.-hr.	657.10
Net cost of service for month to city.	$7,765.02

Table II—Summary of Monthly Billing for Drought Period

Month	Kw.-Hr.	Kw. Demand	Gals. Pumped	Total Bill
A	439,400	705	176,190,000	$5,377.43
B	657,100	956	250,160,000	7,765.02
C	677,300	925	256,840,000	7,840.00
D	101,500	902	21,200,000	2,535.88
Period	1,875,300		704,390,000	$23,518.33
			or per million gals.,	$33.50



THESE two 300-hp. motor-driven pumps reinforced an old stand-by installation at Wachusett Reservoir to deliver Boston metropolitan water into the Worcester system during an emergency

MITCHELL-RAND
for
54 YEARS THE ELECTRICAL INSULATION HEADQUARTERS

FREE FOR THE ASKING!

Write today for your Free Card of Varnished Tubing with samples ranging from size 0 to 20 to fit wires from .032 to .325 inches . . . other valuable aids, are the M-R Guide Book of Electrical Insulation . . . the Wall Chart with reference tables, electrical symbols, allowable capacities of conductors, dielectric averages, thicknesses of insulating materials and tap drill sizes . . . and the M-R Wax and Compound Guide Book . . . they are full of valuable information . . . write for them on your letterhead.

INSULATION M-R COMPANY EST. 1889

MITCHELL-RAND INSULATION COMPANY, INC.

51-B MURRAY STREET COrtlandt 7-9264 NEW YORK, N. Y.

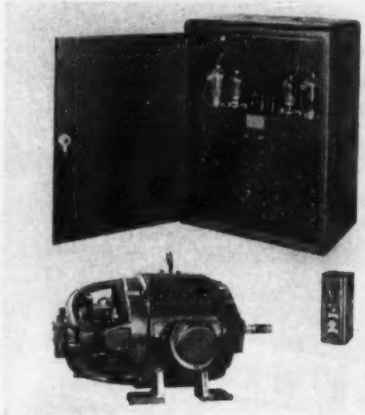
A PARTIAL LIST OF M-R PRODUCTS

- Fiberglas Varnished Tape and Cloth
- Insulating Papers and Twines
- Cable Filling and Pothead Compounds
- Friction Tape and Splice
- Transformer Compounds
- Fiberglas Braided Sleeving
- Cotton Tapes, Webbings and Sleevings
- Impregnated Varnish Tubing
- Insulating Varnishes of all types
- Fiberglas Saturated Sleeving and Varnished Tubing
- Asbestos Sleeving and Tape
- Extruded Plastic Tubing
- Varnished Cambric Cloth and Tape
- Mica Plate, Tape, Paper, Cloth and Tubing

NEW EQUIPMENT

Electronic Drive

New unit drive consists of (1) power transformer, (2) cabinet with thyratron tubes and current limit and speed regulating control, (3) control station with potentiometer to vary the voltage supplied to the armature and field circuits and with start and stop push buttons, and (4) shunt-wound d.c. motor. For a speed range of 10:1, with torque varying from no load to full load, speed will not vary more than 4 percent from a preset value, it is claimed. Maximum variation for the 20:1 speed range is said to be within 8 percent. Present available ratings up to 1 hp. for single-phase operation on 110- or 220-volt, 60-cycle systems; drives for larger horsepower



"Mot - O - Trol" electronic adjustable - speed motor drive; 20:1 speed range for d.c. motors operating from an a.c. source. **Westinghouse Electric & Mfg. Co.**, East Pittsburgh, Pa.

ratings can be designed. Applications are for industrial drives such as winding reels, machine tool feeds, conveyors and fabricating and converting machinery.

•

Frequency Analyzer

"RA-281" sound frequency analyzer; frequency range from 10 to 9,500 cycles per second; band widths 5 cycles standard, others 20, 50 and 200 cycles; any three can be built into instrument; power supply, 110-120 volts, 60 cycles, 0.36 amps. **Western Electric Co.**, 195 Broadway, New York, N. Y.

Designed to measure and record frequencies simultaneously over a wide range, new analyzer consists of three units, a special filter, a special graphic level recorder and either a moving coil microphone or moving coil vibration pick-up. Analysis is usually by the sweep method, using a heterodyne analyzer and a synchronous driving motor coupled to the dial so as to sweep through the frequency range in question at a definite rate. A quartz crystal filter allows frequencies within the selected band to pass.

Photo-electric Controls

New series of photoelectric controls and light sources have same size and type of housings which are said to maintain the units impervious to moisture, dust or weather. Operation speeds to 10 per second. A two-tube amplifier is included for applications requiring a highly sensitive unit. Light sources have lens focal lengths of 2, 4 or 6 in.

"Series 70" photo-electric control (illustrated); contactor capacity 3 amp., 110 volts, 60 cycles; minimum light, ½ and 4 foot-candles. "Series 18" light source, candlepower up to 50. **United Cinephone Corp.**, Torrington, Conn.

•

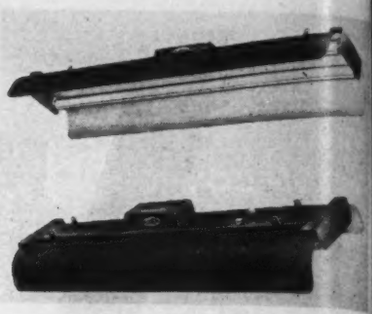
Rheostats

New line of rheostats includes a fixed resistor having slide contacts of laminated phosphor bronze springs with inserted lubricators consisting of graphite carbon pieces. Porcelain tube recessed on two sides is said to make possible greater dissipation of the heat and a tight winding of the wire, and, in turn, will better enable the rheostat to handle overloads without any loosening of the winding.

Type "A" unprotected and type "B" protected (illustrated) single-range slide contact rheostats; ohmic values up to 40,000; current capacities, 0.08 to 25 amp. **Herman H. Sticht Company**, 27 Park Place, New York.

Reflectors

Constructed to conform to Fluorescent Limitation Order 1-78 and amendments, new reflectors are made of a light-weight



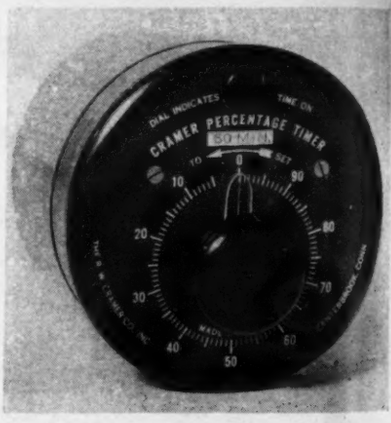
Models "Victory 40," a two- or three-lamp, 40-watt unit, and "Victory 100," a two-lamp, 100-watt unit reflectors; constructed of "Silva-A-Tex"; for either chain or rigid suspension. **Bright Light Reflector Co., Inc.**, Metropolitan and Morgan Avenues, Brooklyn, N. Y.

composition, said to be heat-, moisture- and corrosion-resistant. Reflecting surface is finished with high-gloss, chip-proof, baked white enamel.

•

Timer

New timer is designed to control automatically the percentage of time at which any a.c. circuit can periodically be closed or opened out of a definite length of a time cycle. It is said to be particularly applicable where one function bears a definite time



Percentage timer; available for seven different time ranges from 30 seconds to 60 minutes total cycle; single-pole, single-throw contact is rated at 10 amp. at 115-volt or 5 amp.; inclosed in dust-tight molded bakelite case for flush mounting. **R. W. Cramer Co., Inc.**, Centerbrook, Conn.

relation in percentage or operation of a second function, such as to regulate any input to electrically operated furnaces, ovens or heaters; controlling the proportionate flow of chemicals for boiler feedwater treatment, etc. Device has a self-starting synchronous motor.

BUYING ELECTRICAL EQUIPMENT?—McGraw-Hill's *Electrical Buyers Reference* is a convenient place to look first for manufacturers' product data, names and addresses.

—Like the HUBBARD AUTOGAP Lightning Arrester "Shoots Out" a follow-up arc

In Texas and other oil districts, when a well takes fire, a famous firm of oil field fire fighters is called in to extinguish the blaze. This is often accomplished by "shooting out" the blast after wreckage has been cleared and the fire confined to the smallest possible area, usually the jet emitted from the top of the casing. "Shooting out" consists of placing at the casing, a heavy charge of gelatinous nitroglycerine which, when exploded, destroys contact between the gases and the flames so that the continuous feed of combustible material to the point of ignition is interrupted. There is much more to the trick, but in principle, that is the process.

Hubbard *Autogap* Lightning Arresters employ exactly the same principle, but the "fire" in this case, is electrical, and the dissipating force is supplied automatically by the passage of the current through the arrester. When the current is forced around core "A" and through the minute clearances "B" to reach ground, the confinement and the contact with the fiber surfaces causes an explosion. The gases generated are exhausted simultaneously in opposite directions through vents. The follow-up arc is "shot out" just as the nitroglycerine explosion snuffs out a burning oil well.

For detailed data and diagrams write for an illustrated "Autogap" bulletin containing operating data, installation methods, results of tests and other pertinent information.

HUBBARD AND COMPANY

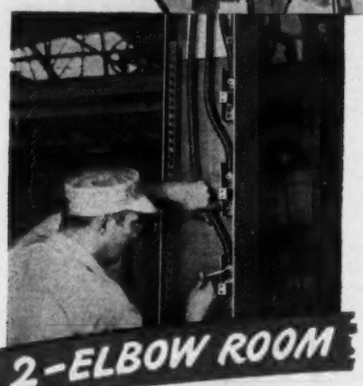
PITTSBURGH . . . OAKLAND CALIFORNIA . . . CHICAGO

HOW TO DO 4 HOURS WORK IN 3

BullDog Narrow Column Circuit Breaker Panels—a Quick Windup to Wiring Jobs

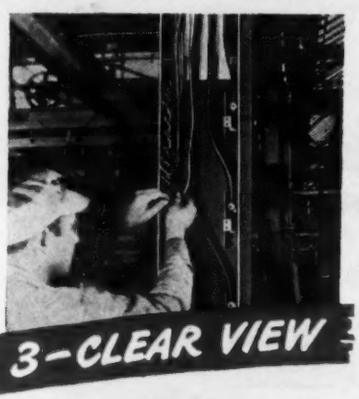
1-ONE MAN JOB

Light, compact pieces—no heavy or complicated parts that take more than one man's time to install.



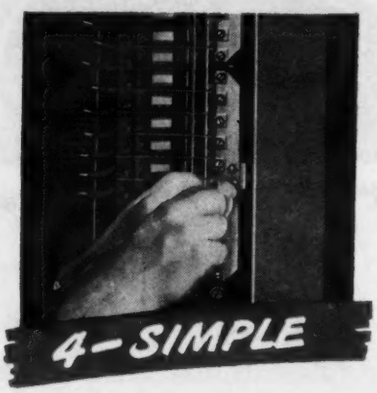
2-ELBOW ROOM

Wireman not slowed by having to work in narrow "side" gutters as cables are pulled and connected.



3-CLEAR VIEW

Work is faster, surer, as branch circuit wires are led to retainers — no groping or guesswork.



4-SIMPLE

Major wiring job done in an empty cabinet — panel is set and connections made to main cables.

5-NO SOLDER

Branch wires are readily inserted and tightened in the Solderless Wire Grips.

Now is the time when plants *must* cut every corner, to save precious maintenance time. BullDog's Narrow Column Panels meet industry's wartime need for speed of installation and ease of upkeep. Write for complete bulletin No. 426, covering various types of BullDog time and money-saving equipment.

MANUFACTURERS OF Vacu-Break Safety Switches, SafToFuse Panelboards, Circuit Master Breakers, Switchboards, Bus Duct Systems—FOR LIGHT AND POWER.

BULLDOG
ELECTRIC PRODUCTS CO.
Detroit, Michigan

BullDog Electric Products of Canada, Ltd., Toronto, Ontario

Field Engineering Offices in All Principal Cities

TECHNICAL LITERATURE

RESISTANCE MEASUREMENTS—Measuring conductor resistance of motor windings, instruments and household appliances, locating grounds and crosses in a cable. Murray and Varley loop methods are outlined in Cat. E-53-400(1), "Type S Test Set," obtainable from Leeds & Northrup Co., 4934 Stenton Ave., Philadelphia, Pa.

"WARTIME CONSERVATION," a 96-page booklet, contains recommendations for selecting, applying and using electrical equipment so as to achieve best possible output with greatest saving in critical materials. Subjects covered include uprating of motors, thermal temperature loading of transformers, industrial network systems, life equipment and materials. Copy of booklet B-3206 may be secured from Dept. 7-N, Westinghouse Elec. & Mfg. Co., East Pittsburgh, Pa.

RUBBER PRODUCTS—"A.S.T.M. Standards on Rubber Products" is a compilation of all standards as of February, 1943. It includes 41 specifications, physical and chemical tests, and emergency alternate provisions and other emergency methods issued to expedite procurement and conserve crude rubber. Copy of the book can be obtained from A.S.T.M. headquarters, 260 South Broad St., Philadelphia, Pa.; price $1.75 per copy.

TRANSMITTING TUBES—Designed as an aid to users of electronic tubes a booklet, "Tips on Making Transmitting Tubes Last Longer," lists five general "good rules to follow," has chapter covering tungsten filament tubes, mercury-vapor rectifier tubes, tube resting periods, and explains why cooler tubes last longer. Copy of the publication is available from RCA Commercial Engineering Section, Harrison, N. J.

STYRALOY 22—Technical bulletin lists electrical and physical properties and fabrication techniques of the synthetic-thermoplastic resin of the hydrocarbon type. Copy of the bulletin may be obtained from Plastics Division, The Dow Chemical Co., Midland, Mich.

VOLTAGE STABILIZER—Fundamental circuit, characteristics, regulation, harmonic content and other technical information is presented in publication GEA-3634, "Automatic Voltage Stabilizer," obtainable from General Electric Co., Schenectady, N. Y.

ALUMINUM—Specific instructions for the commercial processes of gas and electric arc welding, electric-resistance welding, and brazing of aluminum and its alloys are included in a new edition of "Welding and Brazing Alcoa Aluminum," copy is available from Aluminum Company of America, Pittsburgh, Pa.

HARDNESS—A critical examination of hardness, dynamic hardness and an attempt to reduce hardness to dimensional analysis. Historical résumé of attempts to define and determine hardness leading into into a discussion of the experiments and theories of P. Roudié toward expression of hardness in terms of length, mass and time. Available gratis from the Nitralloy Corp., 230 Park Ave., New York, N. Y.

REGULATORS—Theory of step-type regulator operation with connection diagrams, use of automatic control, method of maintaining correct voltage, and a description of the units are included in Bulletin B-6056, "Feeder, Voltage Regulators," issued by Allis-Chalmers Mfg. Co., Milwaukee, Wis.

WESTINGHOUSE
ELECTRIC & MANUFACTURING COMPANY

246 EAST FOURTH ST.
MANSFIELD, OHIO

May 3, 1943

POSTWAR PLANNING
WITH BOTH FEET
ON THE GROUND

When peace comes and the postwar planning you're hearing so much about now can be expressed in actual products -- what will you, as an electrical merchant, be most interested in?

First, we believe, you will want a line of products which you can get for actual selling -- fast!

It's all right to talk about new plastic refrigerators and glass ranges -- but if you have to wait for months before you can get such products, you're not going to play many tunes on your cash register meanwhile!

Second, you will want products that have acceptance. Neither you nor your customers will want to experiment with new and untried products and materials, no matter how novel and glamorous.

You can probably think of several well advertised products that didn't "take" T. J. N.

So we think postwar planning in your interest means our getting into production fast -- getting you a line of products you know will give customer satisfaction -- products that give you low selling cost, low service cost with quick turnover and profits.

To be sure, we have our share of new and revolutionary designs for ranges, refrigerators and whatnot -- and we're as far advanced with them as any patriotic manufacturer should be who is 100 per cent in the war effort.

But -- we have been in this business a long time, and we know that nobody can introduce new and revolutionary things without bugs. And bugs mean delays in getting onto the market, service expense to dealers, disappointment to customers.

How well you know it, too! T. J. N.

So we submit that wise postwar planning in your interest should prompt us to go through two stages:

1. Get into production fast on essentially those products you have sold before -- improve, but

(over)

don't experiment then with radical changes.

2. Bring along the revolutionary new developments as quickly as they can be "proved."

You're going to hear a lot about the new appliances that are coming, postwar. You're going to be told to wait for them. You're going to be told that everything you sold in the past will be obsoleted by what's coming. And that's so -- eventually.

By arrived I mean more than "produced" I mean proved out salewise T. J. N.

All we can say is that products that are "coming" ring no cash registers until they arrive. Rushing into them may mean expense to you. We all know that the products you sold in the past gave mighty good customer satisfaction and performance. And with the huge postwar demand, what is more sensible than to give the public good, proven products -- pronto!

We hope you will agree with this outline of our thinking. We call it "Postwar planning with both feet on the ground."

Of course, there may be some radical new products in the immediate postwar period as a result of new manufacturers who haven't any time-tried prewar designs.

We mean G.E. Frigidaire, Kelvinator and some others T.J.N.

But we (and certain other manufacturers like us) have an experience in this business -- an experience that involves a lot of "know-how" in appliance engineering, manufacturing, and in working with and making money for dealers.

And we know that postwar success involves far more than merely postwar products. Your future and ours is dependent upon continued CONSUMER ACCEPTANCE. That suggests there are many things we both should be doing now for later. Our program for doing these things is outlined in a little book entitled "Your Future and Ours" which I am sending you. I should appreciate your reading it carefully and letting me have your reactions.

If you didn't get your copy please write me T.J.N.

Sincerely,

T. J. Newcomb.

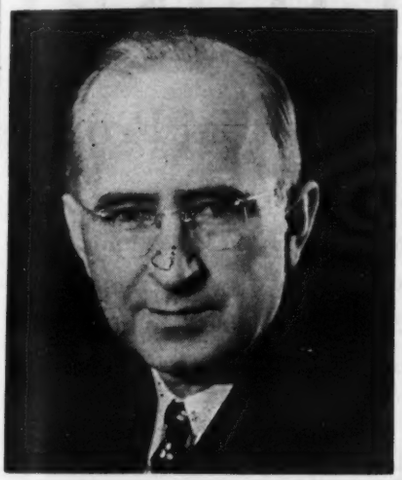
T. J. Newcomb, Sales Manager
Electric Appliance Division

NEWS ABOUT PEOPLE

F. B. Lewis Retires As S.C.E. Vice-President

Fred B. Lewis, vice-president of the Southern California Edison Co., and nationally prominent in the electrical industry, has retired from active service with the company. He remains as a member of the board of directors.

Mr. Lewis entered Edison service



July 6, 1905, in the Edison Co. test department. In 25 years he rose to the position of vice-president and general manager, holding the position from 1931 to 1942. During the past year he has been vice-president, a director and a member of the company's executive committee.

Mr. Lewis has been one of the leaders in the electrical industry's expansion. During the past year Mr. Lewis has served as chairman of the Electric Power Interchange Committee, formed to meet California's demands for power in war production. He has been succeeded as chairman of this committee by N. B. Hinson, executive engineer of the Edison Co.

In 1920, during a power shortage following the last war, he was appointed power administrator in California and took a leading part in developing the interconnection of California power systems. Again in the dry year of 1924 he had the responsibility of meeting serious problems caused by the lack of hydro-electric power. The success with which he solved this difficulty resulted in his promotion to the position of assistant general manager of the Edison Co. on September 1, 1924. He was advanced to vice-president and assistant general manager in 1928, and to vice-president and general manager in 1931. As general manager during the depression years, he again demonstrated his capacity for skilled direction under trying conditions.

•

Century Assigns New Engineering Duties

Announcement has been made of the appointment of Fred Pillsbury to the position of executive engineer of the Century Electric Co., St. Louis, in general supervision of all engineering work and of Sam Wolff as chief electrical engineer in charge of design engineering.

Mr. Pillsbury, son of the president of the company, E. S. Pillsbury, has been associated with the organization for thirteen years, serving in various engineering capacities. Before joining Century, he had obtained excellent

F. Pillsbury

training in factory engineering at the Lynn and Schenectady works of the General Electric Co. during his summer vacations, while a student at Washington University, from which he was graduated in 1930.

S. Wolff

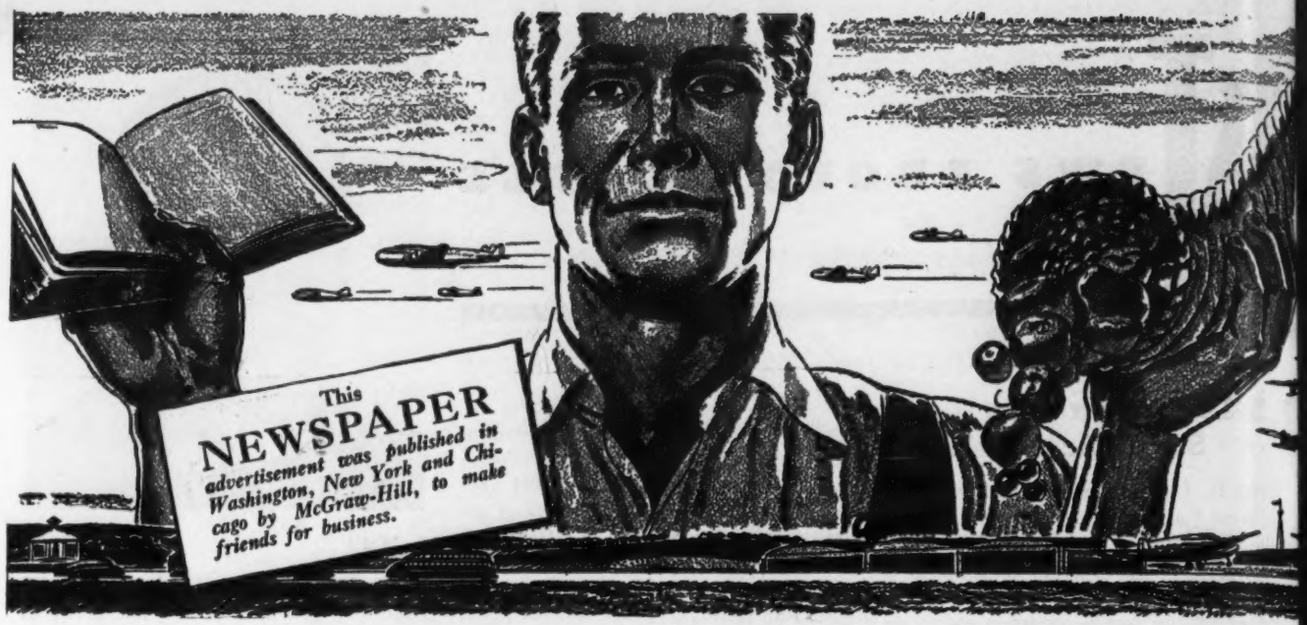
Mr. Wolff, new chief electrical engineer, is a graduate of the University of Illinois. He joined Roth Bros. in 1922 as designing electrical engineer and continued with that organization until 1927 as assistant to the chief engineer. From 1927 to 1934 he was chief engineer of the American Motor Division of Thomas A. Edison, Inc., in Milwaukee. He served as chief engineer for Burke Electric Co., Erie, Pa., and as executive engineer for Diehl division of Singer Manufacturing Co., Elizabeth, before joining Century Electric Co. in 1940 as assistant to chief engineer.

•

▶ T. H. Hogg, chairman and chief engineer of the Hydro-Electric Power Commission of Ontario, Toronto, has been elected honorary president of the Ontario Municipal Electric Association.

▶ Howard Boylan, vice-president and assistant to the president of the California Electric Power Co., has been appointed, in addition, to hold the position of comptroller for the company and associated companies. Mr. Boylan has been connected with California Electric Power Co. for almost 20 years.

▶ J. E. Fife has been appointed manager of the Keystone division of the West Penn Power Co., Ridgway, Pa., to succeed V. E. Rockefeller, transferred to the Pittsburgh office as assistant to the secretary. Mr. Fife joined West Penn in 1919 as an electrician in the substation department. He progressed steadily from foreman to superintendent of substations and in 1934 was appointed superintendent of power stations, substations and lines in Keystone. Since 1940 he has been division operating superintendent. Mr. Rockefeller has been division manager of Keystone for ten years. Entering the employ of West Penn in 1922 as district superintendent, commercial department, Washington, he was appointed to a


This
NEWSPAPER
advertisement was published in Washington, New York and Chicago by McGraw-Hill, to make friends for business.

Do You Believe?

Do you believe that Industrial Progress is the basis of all good living?

That Industry is the source of better living is so clear to you and me that it would seem everybody would understand it.

But when we try it on your friends and neighbors! Or, review the course of history! Or look among our laws to see how many were designed to encourage industrial growth!

You'll find that few people know where good living comes from.

We are trying to explain the source of good living in McGraw-Hill magazines, and in newspapers. A current advertisement is shown here.

We ask other companies, all over the nation, to join us in running the "Seed Money" message. We supply free mats (1,470 line size, for newspaper use) with space for name of local sponsor.

James H. McGraw, Jr.

President

McGraw-Hill Publishing Company, Inc.

GOOD LIVING

Comes *Only* from Industrial Progress

THE more we believe in the Four Freedoms, the greater our obligation to understand them, and to know exactly what we have to do to enjoy *all* of the advantages they imply.

Take Freedom from Want, for instance. Where will it come from? Will it be the gift of a government department? Can it be created by issuing orders and directives?

► Of course not. Executives and government departments get their powers as well as their money from Congress. Can Congress create Freedom from Want by law?

Not in the final analysis. Congress can only allocate the total energies of our nation by law. It can take all the good living there is and divide it up differently.

So, if you happen to live poorly and want to live better, it's to your interest to see that Congress does a very wise job when the time to divvy up arrives.

Reprints of this advertisement are available in booklet form. (Less than 100 copies free. Larger quantities, $1.50 per 100; $10.00 per 1000.)

Good Living Comes Only from Industrial Progress (cont'd)

Congress can assume either that industry can't grow any more and try to solve the problem by dividing up existing jobs, or it can stimulate *more* good living, through wise laws that encourage industrial progress and make more jobs.

► Multiplication will work a lot better than division, in this case.

If Congress will hold on to the fact that art, science, political experiments, luxuries AND necessities *all* must have their foundations in healthy industry, it will be more likely to pass only those laws which encourage industrial growth.

"Seed Money" an Example

When Congress, and the people, realize that business progress is the foundation of all improvement, our tax laws will stop confusing personal profit (salaries and dividends) with reinvested profit.

Profit held for reinvestment is the SEED MONEY of business. It is the money a business saves from current operations to insure future growth.

► Business will need billions of "Seed Money" dollars when the war is over. But, under the present tax law, industry cannot save as it should for that rainy day.

You hear lots of talk about the jobs that will result from the transparent automobiles and the sky-sedans that industry will build after the war, but not enough talk about the need for SEED MONEY to turn those hopes into realities.

The practical fact is that business cannot adjust itself to postwar production without "Seed Money."

► "Seed Money" will pay for the research that must come before new and better postwar products can be built. It will pay for re-tooling when new models are produced. It will pay for the study of methods to get the lower costs that will make it possible for more people to buy. It will pay for setting up new distributors and dealers, and for hundreds of other activities that are involved in the growth of business.

The tax law should be adjusted to allow business to accumulate funds for these necessary tasks of postwar development.

Ask your Congressman to see that American business is given a chance to create jobs after the war, by revising the excess profits tax so as to leave the "Seed Money" and by reviewing all laws with this principle in mind:

"Industrial Progress
is the Source of all Good Living."

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION

22 publications, which gather "war-news" from the "war-production-front" through a staff of 153 editors and 725 engineer-correspondents . . . More than 1,500,000 executives, designers, production men and distributors use the editorial and advertising pages of these magazines to exchange ideas on war-production problems.

McGRAW-HILL BOOKS

Publishers of technical, engineering and business books for colleges, schools, and for business and industrial use.

McGRAW-HILL

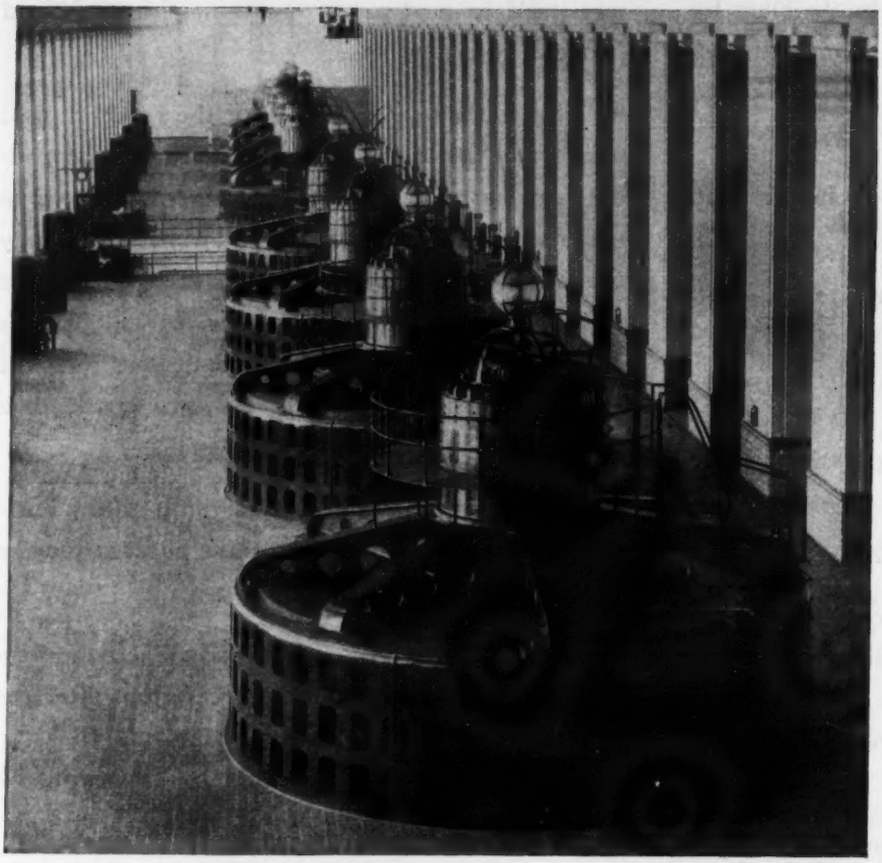
PUBLISHING COMPANY, INC. . . . BOOK COMPANY, INC.

330 WEST 42ND STREET, NEW YORK

THE McGRAW-HILL NETWORK OF INDUSTRIAL COMMUNICATION:

American Machinist • Aviation • Bus Transportation • Business Week • Coal Age • Chemical & Metallurgical Engineering • Construction Methods • Electrical Contracting • Electrical Merchandising • Electrical West • Electrical World • Electronics • Engineering & Mining Journal • E. & M. J. Metal and Mineral Markets Engineering News-Record • Factory Management & Maintenance • Food Industries • Mill Supplies • Power • Product Engineering • Textile World • Wholesaler's Salesman • Business Publishers International Corporation, an affiliate, publishers of Business and Technical Magazines for Latin America, and Overseas Circulation.

ELECTRICITY IS THE LIFEBLOOD OF Vital Industries



duGas

FREE: New chart showing characteristics of all types of approved hand fire extinguishers. Copy sent free on request.

Protect it against fire with duGas!

When fire strikes power plants or electrical equipment...fire is conquered quickly when duGas is near at hand.

Sure and swift in action, duGas cuts precious minutes from extinguishing time...helps guard against dangerous power interruptions.

duGas works fast!

DuGas dry chemical smothers fire the instant it hits flames...for it releases huge volumes of flame-killing gases immediately on contact with fire. Hurts nothing but fire...and being a non-conductor, duGas is safe to use around electrical equipment.

DUGAS ENGINEERING CORPORATION, MARINETTE, WISCONSIN

Owned and Operated by Ansul Chemical Company

similar position in New Kensington in 1924. In 1930 he became division manager at Greensburg, remaining there until his appointment to the Ridgway position in 1933.

•

SKF Announces Three Executive Promotions

Three executive promotions has been announced by SKF Industries, Inc., Philadelphia.

Thomas W. Dinlocker was elected vice-president and treasurer, Richard H. DeMott vice-president in charge of sales and C. P. Collins, secretary.

William L. Batt, vice-chairman of the War Production Board, retains the presidency.

•

▶ LEROY L. WYMAN, metallurgist for some nineteen years with the General Electric Co. research laboratory at Schenectady, has been released for the emergency by his company to join the staff of the war metallurgy committee of the National Academy of Sciences—National Research Council. His principal assignment on the war metallurgy committee is the direction of research in the fields of non-ferrous alloys used in aircraft and ordnance material.

▶ ARTHUR W. CROUCH, formerly assistant in the office of the manager of power of the Tennessee Valley Authority, Chattanooga, has been made administrative assistant to the general manager of the Nashville (Tenn.) Electric Service. Mr. Crouch joined the Tennessee Electric Power Co. in 1921 as an engineer and was engaged in much of that utility's construction work. Among other activities, he rebuilt the McMinnville dam, laid out and supervised major improvements at Hales Bar Village, Hales Bar leakage work, improvements of steam foundations and general improvements in the generating facilities. Over a period of years he prepared much data on flood control and navigation. After the Tennessee Electric Power properties were sold to the TVA he joined the authority.

▶ R. E. ONSTAD, formerly vice-president and general manager of the Thordarson Electric Manufacturing Co., Chicago, has been made president and general manager, following the resignation of C. H. THORDARSON as president. Mr. Thordarson, who founded the company nearly a half century ago and who is now nearly 76 years of age, will continue his association with the organization as technical consultant. At the same time the board of directors announced that L. G. WINNEY, formerly treasurer, has been named vice-president and

Here's the ANSWER to your INSULATING ★ OIL ★ PROBLEM

THE De Laval Insulating Oil Purifier materially reduces the cost of maintaining transformer and circuit breaker oil at high dielectric strength. The time and expense of servicing each individual piece of apparatus is reduced, and more frequent dehydration of the oil to maintain it at uniformly higher dielectric value becomes economically possible.

De Laval Insulating Oil Purifiers assure high-test oil at a single pass and at high capacity. Water is continuously discharged and oil is purified at relatively low temperature. High efficiency of purification is maintained during long runs.

Automatic oil flow control and thermostatic heat regulation enable practically automatic operation. This feature is enhanced by the fact the De Laval Purifier does not require the aid of a blotter press in purifying transformer oil. A press may be used in series with the purifier for removing colloidal carbon from circuit breaker oil.

Portable and stationary units, available in several sizes, are described in Bulletin No. 107.

DE LAVAL

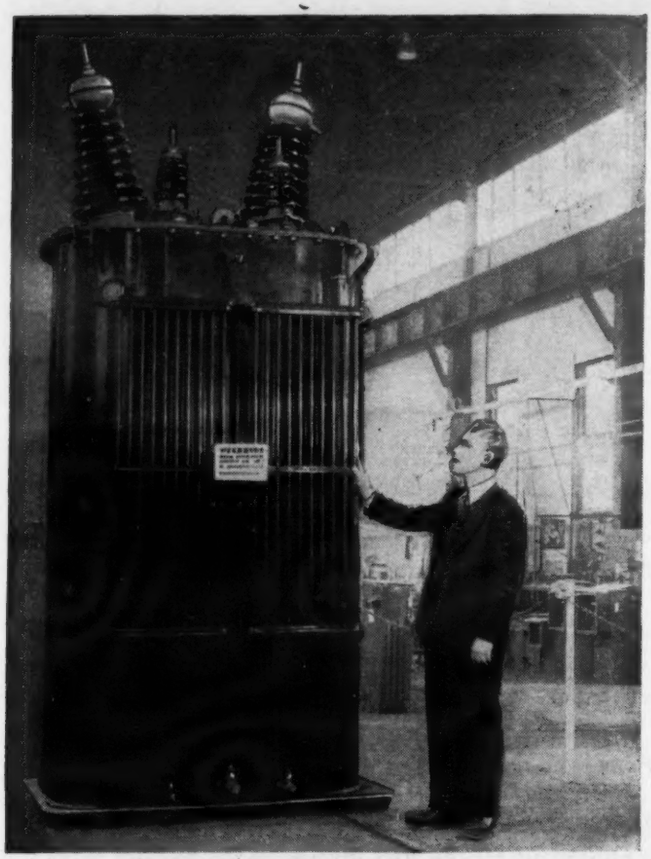
INSULATING OIL PURIFIERS

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 427 Randolph St., Chicago
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco
THE DE LAVAL COMPANY, Limited
Montreal Peterborough Winnipeg Vancouver

UPTEGRAFF TRANSFORMERS

on quick delivery

Uptegraff



333 KVA—66,000 Volts
Built in March, 1943

Designed by the Uptegraff Engineering staff, built in the Uptegraff plant—you can have your requirements in Transformers met without delay.

Organized to carry through in orderly production, with the regular line of work, your Uptegraff designed and built Transformers will reach you without push nor rush.

Let us know your present requirements

R. E. UPTEGRAFF Manufacturing Co.
SCOTTDALE · · · PENN'A · U.S.A.

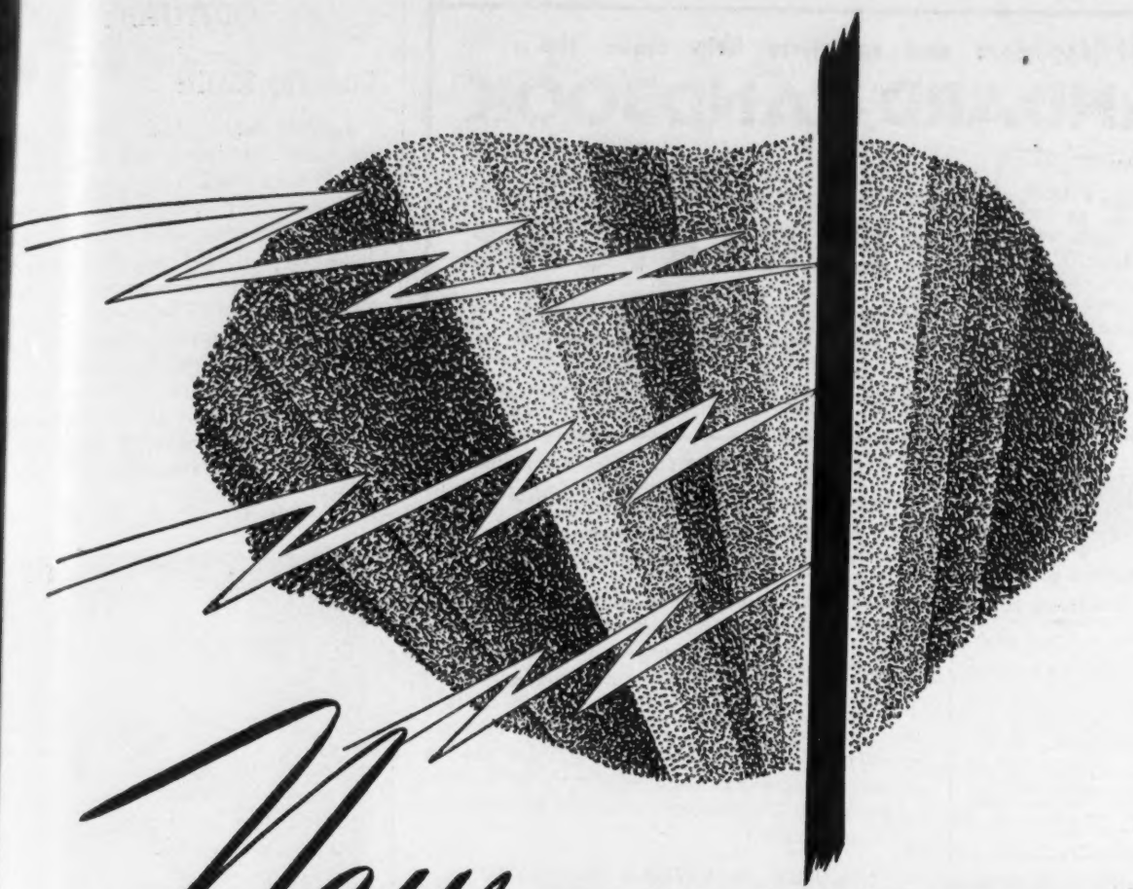
treasurer, and W. R. MAHONEY, formerly connected with Arthur Anderson & Co., has been elected assistant treasurer.

▶ T. M. CUMMINGS has been appointed executive vice-president and general manager of Progressive Welder Co., Detroit. Mr. Cummings has been vice-president of Progressive since the company was founded in 1933. For the first year he was in charge of manufacturing and engineering development. With manufacturing and engineering divisions organized, he was placed in charge of sales development. As executive vice-president and general manager Mr. Cummings will be in complete charge of all operations.

▶ GEORGE W. BOWER, assistant to division superintendent, Camden area, Public Service Electric & Gas Co., Newark, N. J., has been appointed engineer in the company's general office. JOHN H. THOMPSON, formerly district superintendent, Elizabeth district, has been made assistant division superintendent, Camden area. ARTHUR R. HORNER has been appointed to succeed Mr. Thompson in Elizabeth. He was formerly district superintendent, Bound Brook. STANLEY H. WILCOX, formerly district distribution engineer, Bound Brook, has been promoted to district superintendent, replacing Mr. Horner.

▶ SIDNEY R. SNOW has been appointed assistant to vice-president (operations) of American Steel & Wire Co. In his new position he will handle operating costs. JOHN R. GAUT has been named general superintendent of the Waukegan (Ill.) Works of the company, succeeding Mr. Snow. Mr. Snow held various positions at Waukegan until he was made general superintendent of the Waukegan Works in 1941. Mr. Gaut became identified with American Steel & Wire in 1919 and for the past two years has been assistant general superintendent of the Waukegan Works.

▶ DR. WALTER S. LANDIS, vice-president of the American Cyanamid Co., has been awarded the gold medal of the American Institute of Chemists. This medal, which is awarded annually for outstanding services to the science of chemistry, is being presented to Dr. Landis not only in recognition of his contributions to chemical engineering and development work, but also for his services to the professional side of chemistry. Many patents have been granted to him and he is the author of numerous articles on chemical, financial and economic subjects. He is a past-president of the Electrochemical Society and has also served as chairman of its New York section, as well as of the New York section of the American Chemical Society.



New BARRIERS to Confine Electric Current!

War is destructive but not all effort that goes into the big fight is wasted. Some of it is going to pay mighty big future dividends. That is especially true of the war work that is going on in the country's laboratories.

At Formica this work has resulted in the development of some new insulating materials with new and valuable characteristics which will be doing important jobs in American electrical products long after the war is over.

Three new grades MF, FF-10 and FF-41 accomplish things that could not be done previously with this laminated insulation. MF is a glass mat base for applications requiring low loss at radio frequencies (Power Factor .011; Dielectric Constant 4.6; Loss Factor 0.05 at 1 Megacycle).

F-10 is Fiberglas fabric base material combining good dielectric strength and heat resistance. And FF-41 is designed to resist arcing.

These materials have a new and important usefulness. At present they are available only for the most essential war uses. But later they will be widely applied.

ARMY E NAVY

FORMICA

THE FORMICA INSULATION CO., 4630 SPRING GROVE AVENUE, CINCINNATI, O.

Now—102 engineers and scientists help make the

STANDARD HANDBOOK for ELECTRICAL ENGINEERS

dependable and practical for you

"As a single volume aiming to be of practical and theoretical interest to the electrical engineering fraternity, it is doubtful if a more convenient, more comprehensive reference exists." ELECTRONICS

ARCHER E. KNOWLTON, *Editor-in-Chief*

Associate Editor for Engineering, Electrical World

7th Edition, 2303 pages 6x9, 1700 illustrations, 600 tables, $8.00

What the Standard gives you

—definitions, conversion factors, physical and mathematical principles.

—accepted formulas and experimental data

—bases of design of electrical equipment for commercial performance

—principles and practice of assembling such apparatus into systems.

—criteria and results in applying electricity in various industries, etc.

—the information you want in the form in which you can use it; the means of avoiding errors, saving time and trouble in procuring vital information, assuring yourself of best results in handling a wide variety of problems.

Here is the great standard reference work of all in the electrical engineering profession or whose work in industry or engineering touches on this field. Its 2303 pages present a handy-reference compilation of practical, usable data from all fields of electrical engineering practice, plus the most frequently required fundamental theory, units, and systems of measurement, made dependable by the work of more than 100 engineers, scientists, teachers, and other authorities.

Thousands of useful facts in these

26 BIG SECTIONS

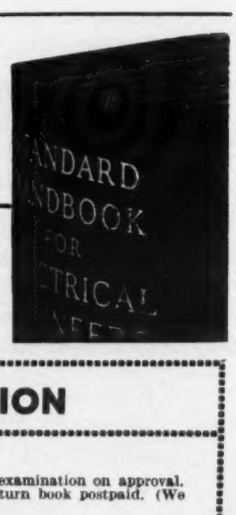
Units and Conversion Factors
Electric and Magnetic Circuits
Measurements
Properties of Materials
Circuit Elements
Transformers, Regulators and Reactors
Alternating-current Generators and Motors
Direct-current Generators and Motors
Rectifiers and Converters
Prime Movers
Power Plant Economics
Power System Electrical Equipment
Power Transmission
Power Distribution
Wiring Design—Commercial and Industrial Buildings
Illumination
Industrial Power Applications
Electric Heating and Welding
Electricity in Transporation
Electrochemistry and Electrometallurgy
Batteries
Wire Telephony and Telegraphy
Electronics and Electron Tubes
Radio and Carrier Communication
Codes and Standard Practices
Electrophysics

DESIGNED TO USERS' SPECIFICATIONS

Before setting the pattern for the Seventh Edition, the Editor-in-Chief interviewed a large number of users of previous editions, to see what they would like the new edition to be. As a result of their suggestions, the Seventh Edition contains such basic improvements as more emphasis on handy-reference compilation of usable facts, less historical material and more data about equipment, materials, and practices, more sources of industry standards, codes and specifications, and expanded index, as well as complete revision of subject matter to keep abreast of current practice.

SEVENTH EDITION

- every section fully revised
- whole new sections; actually hundreds of pages of new material
- more contributors; every section treated by an expert
- new format; larger page, larger type, larger diagrams



Benefit as thousands have

Tens of thousands of engineers have benefitted from former editions of the Standard. With this Seventh Edition you will too. On hand when you need it, the book gives security in troublesome situations, saves dollars, hours, and effort by giving the right, dependable answer at the right time. Take this easy step that may mean much to you later. Mail the coupon today.

10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK CO., Inc., 330 W. 42nd St., New York

Send me a 7th edition Standard Handbook for Electrical Engineers for 10 days examination on approval. Within 10 days of receipt, I will send you $8.00, plus few cents postage, or return book postpaid. (We pay postage on orders accompanied by remittance.)

Name .....

Address .....

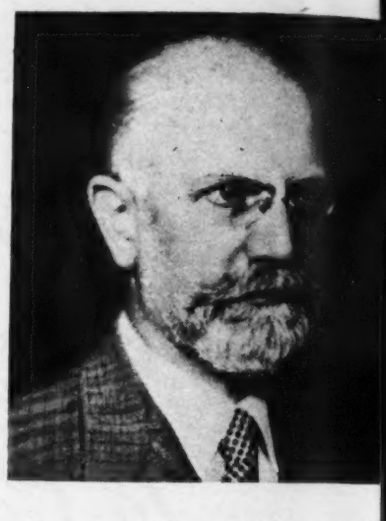
City and State .....

Position ..... Company ..... W. 5-1-43

OBITUARY

Ludwig Kallir

Ludwig Kallir, retired chairman of the board of directors and chief engineer of the A.E.G. Union Electric Manufacturing Co., Vienna, Austria, died on January 7 in a London, England, hospital. He was 68 years of age. Mr. Kallir had been prominently identified with power generation, transmission and distribution in Central Europe for more than 40 years. He represented his country at many international conferences as an official delegate; as such he spent some time in this country during the 1936 World Power Conference.



Born in Austria in 1874, he received his engineering education at the Vienna Institute of Technology, was graduated with highest honors, and stayed there for the following four years as an instructor in electrical engineering until he joined the Union Electric & Manufacturing Co., Vienna, which was later bought by the A.E.G. Berlin and became as the Austrian branch the A.E.G. Union Electric & Manufacturing Co. In 1908 he was assigned the duties of head of the central station engineering department, later became a member of the board of directors, and finally its chairman and chief engineer. He retired in 1937, keeping on in Vienna in a consulting capacity. In 1939 he went to England.

Dr. Kallir was a member of the American Institute of Electrical Engineers, the Institution of Electrical Engineers (British), the Swiss Institute of Electrical Engineers, the International Conference on Large High-Voltage Systems (CIGRE) in Paris, the Austrian Illuminating Society and a former president of the Austrian Committee of the International Electrical Commission and of the Austrian Institute of Electrical Engineers.

THESE PARAGONS OF PERFORMANCE

Speed output

They save precious man-hours . . . step up human efficiency . . . aid mightily in reaching those high-production goals.

Paragon Automatic Timers are being used in thousands of industrial operations . . . such as: Watchman signals, power disconnect, conveyor operation, pump operation, light exposure, liquid agitation, enamel baking, heat treating, rubber curing, plastic molding, etc.

Ask a Paragon Timer Engineer to help plan your present or post-war equipment. No charge; no obligation.

WRITE FOR THIS BOOK

. . . Describing industrial timers, time-switches and other time controls. Contains illustrations, construction and installation data, list prices and reference information.

* Manually reset interval timer 4⅜" high, 2½" wide, 1⅞" deep, for surface mounting on standard handy box.

PARAGON ELECTRIC COMPANY

407 S. Dearborn St. • Chicago, Illinois

Paragon Chicago

BUILDERS OF ELECTRICAL EQUIPMENT SINCE 1905

J. W. Rickey

James W. Rickey, formerly chief hydraulic engineer of the Aluminum Co. of America, died in Washington, D. C., on April 19, after a long illness. He was 71 years old. Since his retirement in 1927 Mr. Rickey had made his home in Washington. He continued to serve the Aluminum Co. in an advisory capacity and had also recently rendered the government valuable service on national defense problems.

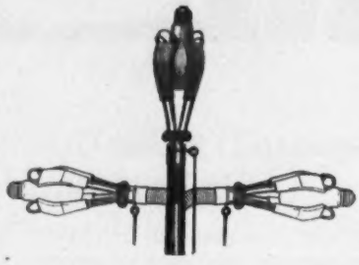
A native of Dayton, Ohio, and a graduate of Rensselaer Polytechnic Institute, Troy, N. Y., Mr. Rickey received his early experience with the Northern Pacific Railway in Minneapolis, the St. Anthony Falls Power Co. and the Minneapolis Mill Co. In 1907 he was engaged by the Aluminum Co. of America as its chief hydraulic engineer. For the next thirty years he designed and supervised many of the structures and developments planned and carried out by the company.

Mr. Rickey made an exhaustive study of the undeveloped water power in the South which subsequently led to the company's acquisition of power sites on the Little Tennessee River and its tributaries. In 1916 he directed the construction of the Cheoah Dam and power house in North Carolina, which was the highest spillway-type dam in the country when it was built. His greatest accomplishment was probably the construction of the Chute-a-Caron development on the Saguenay River, Quebec. The finished structure at Chute-a-Caron is 200 ft. high, yields about 200,000 hp. and forms the first section of one of the largest hydroelectric developments in the world.

•

► Louis D. Gibbs, 73, superintendent of Boston Edison's advertising department for many years prior to his retirement, and for a time assistant head of its public relations bureau, died at his home in Newton, Mass., on April 21. He was born in St. Johns, Mich., and after being graduated from Oberlin College in 1898 engaged in newspaper work at Springfield, Mass., and Washington, D. C., serving for a time also as secretary to Congressman F. H. Gillett of Massachusetts. He joined the Boston Edison staff in 1906, remaining until 1935. During this period he was president of the then New England section, National Electric Light Association, and of the Public Utilities Advertising Association. Mr. Gibbs was a gifted speaker on industry policies and a leader in constructive public and employee relations thinking, being widely known in the electrical field for his practical idealism.

MATTHEWS HOLDFAST LAMP CHANGERS



Removes and replaces lamps in high places, such as ceilings, side walls, electric signs, etc. Like a human hand on the end of a wooden pole. Saves time and prevents ladder accidents.

To remove or replace lamps from side walls or at an angle, pull cord attached to the swivelled ring. This bends the wristlike coil spring so that the Changer will work just as well at a right angle to the rotating pole as in vertical position.

Shipping weight each, 1 pound.

No. 2

For 50-Watt Rough Service, 15 to 100 Watt Mazda and other lamps up to 3 inches in diameter.

No. 2	Less Than 6	6 to 11	12 or More
Price Each	$5.00	$4.75	$4.50

No. 3

For 60 to 500 Watt Mazda Lamps and other large and odd shapes up to 5 inches in diameter.

No. 3	Less Than 6	6 to 11	12 or More
Price Each	$5.50	$5.25	$5.00

All Prices F.O.B. St. Louis, Mo.

Specially treated wood handles can be furnished in 6-foot sections at $3.75 per section including couplings.

Your Electrical Supply Jobber Will Fill Your Order.

W. N. MATTHEWS CORPORATION

ST. LOUIS, U. S. A.

MANUFACTURING-MARKETS

Square D Sales Up in First Quarter

Sales of Square D Co. in the first quarter this year were somewhat larger than in the corresponding period of 1942, the total approximating volume handled in the December quarter last year, F. W. Magin, president, told stockholders at the recent annual meeting. "It appears that volume for the whole of 1943 should exceed 1942 sales of $39,349,044," he said.

Stockholders voted approval of a retirement plan designated to provide income upon retirement for certain salaried eligible employees at the age of 65 years. The plan will become effective as of March 31, 1943, upon approval of the U. S. Internal Revenue Department.

Stockholders also voted to reduce the authorized preferred stock of 17,450 shares, thereby canceling 1,550 shares retired last June through operation of a retirement fund into which not less than 5 percent of net profit is paid each year. Directors at a later meeting authorized the purchase or redemption of an additional 1,450 shares this year, which when effected will reduce outstanding preferred stock to 16,000 shares.

•

G.E. Net, $10,422,576; Taxes Up 47%

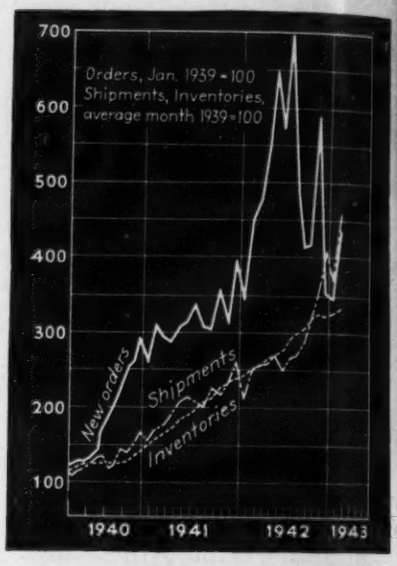
General Electric Co.'s profit available for dividends for the first three months this year amounted to $10,442,576, compared with $10,329,774 for the similar period last year, or 36 cents a share of common stock in each period, President Gerard Swope announced at the recent annual meeting of stockholders. These amounts were after provision of $66,000,000 and $45,000,000, respectively, for federal taxes on income and for post-war adjustments and contingencies, an increase of 47 percent.

Orders received during the first three months this year amounted to $422,047,000, compared with $299,120,000 for the first quarter of 1942. Net sales billed (representing shipments) during the period totaled $277,872,103, compared with $190,861,108 for the similar period a year ago, an increase of 46 percent.

•

Orders, Shipments Spurt in February

New orders received by manufacturers of electrical machinery during the month of February advanced sharply, according to the index compiled by the Bureau of Foreign and Domestic Commerce. The index moved upward to 435 from 346 (revised) in January. It stood at 452 in February, 1942.



ELECTRICAL MACHINERY INDICES of Bureau of Foreign and Domestic Commerce

Recovering from the comparatively light volume of the previous month, the index of the value of electrical machinery shipments in February resumed its record pace, rising to 457 from 369 (revised) in January. The index in February, 1942, was only 249.

Only a slight change occurred in the electrical machinery inventories index —February, 332.2; January, 327.0 (revised); February, 1942, 250.3.

•

A.S.A. Committee Postpones Work on Wire Sizes

Announcement has been made that the subcommittee on wire and sheet metal gages of A.S.A. committee B32 on the same subject has decided to postpone final action on the proposed American Standard for Preferred Sizes for Bare and Metallic-Coated Round Wire until after the close of the war.

Last December the subcommittee held a meeting to receive the report of its

JOHNS-MANVILLE "E"—More than 4,000 Johns-Manville workers and members of their families celebrated the formal raising of the Army-Navy "E" award to the company's Manville, N. J., factory recently. Principal speakers were Major-Gen. Thomas E. Robins and Lewis H. Brown, Johns-Manville president. John E. Begert, plant manager, accepted the flag on behalf of the workers

LIGHT FROM FLOORS brings 20% more light

Light-colored concrete floor made with Atlas *White* portland cement reflects more light than a floor made with *gray* portland cement and very much more than a floor made with still darker materials. Installations in aircraft plants for Boeing, Consolidated, Douglas and North American prove this. Extensive lighting tests show that a white-cement floor, compared with a gray-cement floor in the same plant—

- ***Provides 20% more light on vertical work surfaces (see illustration);***
- ***Reflects 61% more light to underside work surfaces.***

These increases in illumination sharpen vision, reduce accidents, decrease spoilage, increase production.

Concrete floors made with Atlas *White* portland cement have the same characteristics, including durability, as concrete floors made with gray portland cement. In addition, they are light in color.

Maintenance is simple—frequent sweeping, occasional damp mopping, periodic scrubbing.

Send for new book, "Light from Floors." Write Universal Atlas Cement Company (United States Steel Corporation Subsidiary), Chrysler Building, New York City.

EW-F-15

ATLAS WHITE CEMENT
For Light-Reflecting Floors

subgroup which had developed the proposed standard. Copies of the proposal had been sent out to industry for criticism in February, 1942, and the canvass had resulted in a number of disapprovals, the subgroup reported. After reviewing the report, which indicated that one-fourth of the replies expressed disapproval or counseled delay, the committee decided to postpone final action until the close of the war.

•

Manufacturers Make Sales Assignments

Electrical manufacturers have recently announced the following appointments to their sales staffs:

The Bristol Co., Waterbury, Conn., has announced the appointment of George R. Atkins as manager of the branch sales office and factory in Akron, Ohio. Mr. Atkins joined the Bristol Co. sales organization in 1929, starting in the New York office. He will maintain headquarters at the company's branch sales office and factory at 727 Grant St., Akron, Ohio.

The following changes in office addresses and personnel of the application engineering organization were recently announced by the Lincoln Electric Co., Cleveland, Ohio. H. H. Stahl of the Philadelphia office, has been transferred to Boston as district manager of that area, in addition to his welding application work; R. J. Shepherd, formerly of the Toledo office, to the Philadelphia office; C. M. Richardson, formerly of the Moline office, to the Toledo office as application engineer and district manager; and W. J. Barrett was transferred from the Moline office to the Detroit office. C. B. Herrick of the Philadelphia office has been given leave of absence from the company to assist the Jefferson Boat Works, Jeffersonville, Ind.

Progressive Welder Co., Detroit, has appointed A. D. Lewis West Coast service and sales representative with headquarters at 4328 San Fernando Road, Glendale. He will cover the State of California.

Victor Insulators, Inc., has appointed David D. Schneider sales agent for the state of Kentucky, with offices in the Kenyon Building, Louisville.

•

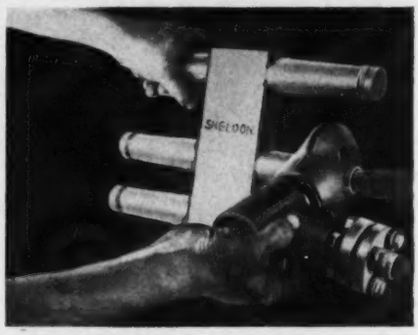
New Product Reduces Mica Stock Drain

Relief is promised from a critical shortage of strategic mica imports, according to General Aniline & Film Corp. announcement. Priorities have been granted for the immediate erection of a plant for the production of "Polectron" Synthetic, a primary substance used in strategic mica replacement material. It is expected that the new synthetic material will substantially reduce the drain on America's imported mica stockpile, most of which is earmarked for war production. Its high-temperature resistance, combined with low dielectric loss, makes it useful in several types of radio equipment now requiring mica.

FOR CORRECT ENGINEERING STANDARDS SPECIFY SHELDON

SHELDON KOMPRESS
HYDRAULIC COMPRESS PRESS

Admittedly* the most reliable and inexpensive method of making compression joints on tubular type connections used in underground work.



AND THESE 6 FACTS PROVE IT!

1. **Lightweight—only 27 lbs.**
2. **Small size—operates in manhole.**
3. **Ample hose length—reaches from street pump to work.**
4. **Efficient—foot operation frees hands.**
5. **Safe—insulating coupler protects against shocks.**
6. **Accurate—die head marked for proper indentations.**

* One System reports 200 Sheldon Kompress Units in operation daily for 6 years with maintenance costs too negligible to record.

Complete dimensional data in our catalog.

SHELDON
SERVICE CORPORATION
Long Island City, N. Y.

"YOU'RE WELL CONNECTED WITH SHELDON"

That transmission line fact you want is HERE...

No matter what it may be, you will find complete data in this practical handbook for linemen, foremen, and other employees of line departments.

Revised, enlarged, 2nd edition of

THE LINEMAN'S HANDBOOK

652 pages, 6x9
682 illustrations
$4.00

by
EDWIN KURTZ

This handbook covers everything the practical man wants to know about every phase of transmission line work. It is a handy volume packed with workable plans, methods, kinks, short cuts, tables, diagrams, and photos on every aspect of materials, poles, towers, stringing, guying, trouble-shooting, first aid, etc. Use it as thousands of other line department workers have—to check your methods against the practice of others, to get fast, dependable answers to problems that arise on the job, to brush up on special points, and for consistent study to improve your knowledge, grade, and earnings.

HUNDREDS of FACTS

How-to-do-it methods, time and trouble saving suggestions given in these chapters:

1. Elementary Electrical Principles
2. The Electric System
3. Distribution Circuits
4. Line Materials
5. Line Equipments
6. Line Protective Equipment
7. Line-control Equipment
8. Fundamentals of Line Design
9. Pole-line Erection
10. Tower-line Erection
11. Inspection, Testing, and Maintenance
12. Rural Lines
13. REA Manual of Operation and Maintenance
14. Safety Methods In Construction of Overhead Lines
15. Pole-top Resuscitation
16. First Aid Talks
17. Accident Prevention Course for Linemen

10 DAYS' FREE EXAMINATION

McGraw-Hill Book Co., Inc.
330 West 42nd Street, New York

Send me Kurtz—Lineman's Handbook for 10 days' examination on approval. In 10 days I will send $4.00 plus few cents postage or return book postpaid. (We pay the postage if you remit with order.)

Name .....

Address .....

City and State .....

Position .....

Company FW-5-1-43

Field Reports on Business

Radio and communication apparatus is selling at a fast rate. Large contracts are being placed in various sections of the country, involving wiring supplies. Among the new orders of interest are those for automatic fire alarm systems. Under the impetus of the Easter Season retail sales advanced sharply.

NEW YORK

Activity on the stock market shows considerable evidence that the interest of investors is trending to shares that have a post-war significance. The groups of shares gaining in this respect include: consumer durable goods issues; retail store and mail order stocks; building material manufacturers and related issues; farm equipment issues; manufacturers of industrial equipment whose activities have been curtailed due to the war effort; issues of companies with properties abroad and, last but not least, companies whose earnings have been reduced by high wartime taxation. In this latter category may be listed public utilities and electrical issues. The activity in the utility issues suggests that a more conservative political trend and a belief that regulatory policies will become less drastic has a good deal to do with the keen investment interest in these securities.

The Federal Reserve Board reports that department store sales were 15 percent higher nationally during the latest week than for the corresponding week a year ago. Boston was up 17 percent, New York 10 and Philadelphia 25 percent. For the latest four-week period the increase nationally was 7 percent over 1942.

Civil engineering construction in continental U. S. for the latest week totaled $83,165,000, 11 percent lower than the previous week, but 61 percent below the corresponding 1942 week, according to *Engineering News-Record*. The current week's construction brings the 1943 total to $1,171,009,000—54 percent lower than the 17-week period in 1942.

CHICAGO

Decreasing construction activity is beginning to be reflected in a reduced volume of heavy electrical equipment orders from industrials, Chicago electrical manufacturers report. Volume is being held up to some extent, however, by orders from outlying areas and lend lease. Bulk of the smaller electrical manufacturers have converted their plants and are engaged in war sub-contract work.

Increased maintenance of electrical equipment is being reflected in a general upturn in activities of service and repair departments of the larger electrical manufacturers and in an increased volume of orders for spare parts for utility and industrial classes of apparatus, observers state.

Used electrical equipment dealers report the number of orders is currently about 20 percent above "normal," with the dollar volume 2½ to three times the normal average. This is interpreted to indicate that the larger machines, motors and generators are most in demand. Greatest demand is for high speed (1,200 r.p.m. and above) motors and generators. Demand for large generators of around 600 r.p.m. is dormant.

During the week ended April 22 some 82 Chicago concerns received 147 war contracts totaling $13,260,000. It is significant of the decrease in construction that of this total amount only $618,000 was represented in contracts for construction. The balance was for manufactured goods.

NEW ENGLAND

The Navy is very active in the electrical market. Westinghouse's East Springfield plant is manufacturing electric coolers for transports, each ship to be supplied with enough units to furnish 800 gals. of 50-deg. drinking water per hour. Barnstead Still and Sterilizer Co., Boston, has sold 400 portable stills; International Equipment Co. has received an order for 75 centrifuges, and B. F. Sturtevant will furnish 353-35 gal. ballast pumping units. Orders for Arcovox Corp. capacitors are being placed in good volume. Radio and communication apparatus is selling fast. Orders for field signal generators were placed last week with a prominent manufacturer.

The C & K Electric Co. has received a contract for wiring a shipyard addition in Rhode Island. American District Telegraph Co., Portland, Me., will install an automatic fire alarm system, costing about $50,000, and Ley Construction Co., Springfield, Mass., has been awarded a contract for an addition to hospital buildings serving Western Massachusetts, at a cost of about $100,000. Another contract which will involve wiring for light and power calls for the enlargement of a maternity hospital at New London, Conn., which will be carried out by Cuzzi Bros., Mt. Vernon, N. Y.

Connecticut manufacturers have submitted Navy tenders for 55,000 snap switches and a Massachusetts concern has quoted on 8,000 telephone head harness sets. Interest in heavy propulsion storage batteries is noted by a number of bids submitted by manufacturers in this district.

PACIFIC COAST

The value of building permits for the seven western states is now running 50 percent below that of 1942 and 70 percent below 1941. The March value for the Northwestern states, however, slightly exceeded that for last March.

A $15,000,000 appropriation is being sought to complete the Shasta and Friant and other features, principally pumping, of the Central Valley project for irrigation and power. The Bonneville system has contracted to construct a plant at Hanford, Wash., that will ultimately add 140,000 kw. to its power resources.

The city of Tacoma is preparing plans for its second Nisqually power development. Additions to Columbia Steel's plant at Provo, Utah, will bring its installation value to $150,000,000 and $1,700,000 additional housing is under way for new workers.

New orders of varied interest include automatic fire alarm systems for several gunnery and naval ammunition depots; elevator cable for several large renovated public buildings; portable power plants and floods for Bonneville system; a million feet of 4-inch fibre conduit for the Signal Corps, or several trainloads; a low bid to Seattle of $14,850 from Standard Transformer Co.; 2,000 small combination motors for a coast manufacturer of sirens and industrial horns; and a million pounds of welding electrodes, costing $66,000.

"LONG LIFE"* says:

"WIDE FLUCTUATIONS IN LINE VOLTAGE ARE NO PROBLEM for ARTKRAFT HOT CATHODE FLUORESCENT LIGHTING"

Here's Why:

SIGNS OF LONG LIFE

Wide fluctuations in line voltage does not rule out modern fluorescent lighting when the Artkraft Hot Cathode Lighting System is used, because Constant Voltage power packs, an exclusive Artkraft feature, assure efficient operation at 85 to 135 volts. This means that a good lighting job can be done with Artkraft equipment where bad voltage conditions or overloaded lines would make it impossible with any other known equipment. It is also adaptable to 220 and 440 volt operation in single or three-phase. Also the current-limiting characteristics of Constant Voltage cause the voltage to go to zero when a short occurs and it remains at zero until short is relieved — it will not blow a primary fuse.

OTHER EXCLUSIVE FEATURES OF ARTKRAFT ARE:

NO STARTER SWITCHES:

This bugbear of fluorescent lighting is eliminated by the resonant starting of Constant Voltage.

GUARANTEED LAMPS:

The Artkraft Hot Cathode Lamp is guaranteed 3,000 hours, with a rated life of over 5,000 hours. It has been field tested under adverse conditions for over five years. Blackening in light column is reduced by exclusive cathode design, assuring a brighter lamp.

100% POWER FACTOR—

at rated voltage and 98% or over within 85 to 135 volt range. (In almost all cases will not vary more than 98% to 2% leading.)

"EASY MOUNT" NON-FERROUS REFLECTOR:

Permits instant mounting or removal for cleaning without the use of tools.

Artkraft exclusive features greatly reduce maintenance costs. No starter switches to replace. Lamp replacements less frequent. Ballast replacements unknown. More hours saved by making these replacements unnecessary.

WRITE FOR FOLDER F-102.

WHOLESALERS:

Write for our proposition

FIXTURE MANUFACTURERS

We are pleased to announce that the Artkraft Hot Cathode Fluorescent Lighting Systems are now available through the manufacturing and distributing facilities of the

EDWIN F. GUTH COMPANY
F. W. WAKEFIELD BRASS COMPANY
and FOSTORIA PRESSED STEEL CORP.

Their product will henceforth be known as Guth-Artkraft Fixtures, Wakefield-Artkraft Fixtures and Fostoria-Artkraft Fixtures. Other fixture manufacturers who have not as yet investigated the Artkraft license proposition are urged to do so at once.

ARTKRAFT
HOT CATHODE
FLUORESCENT LIGHTING
Division of
THE ARTKRAFT SIGN CO.
1115 E. KIBBY ST.
LIMA, OHIO, U.S.A.

*Reg. U. S. Pat. Off.

Recent Rate Changes

TAMPA ELECTRIC CO., Tampa, Fla., has announced a reduction in electric rates that will apply to all residential and commercial consumers served by the company outside Tampa city limits and save them approximately $250,000 a year on the basis of present use. Peter O. Knight, president of the company, said the new schedule will be in effect with all meter readings after May 1. Approximately 20,000 residential consumers will realize savings. "The new rates," company officials said, "are substantially similar to those installed by the company inside Tampa city limits on October 1, 1942, and where any changes were made therefrom it was to eliminate the possibility of increase in the bill of any consumer." The reduced schedule is in keeping with the company's previously expressed policy of extending lower rates to all consumers outside the City of Tampa as well as inside, just as soon as it could be done.

PUGET SOUND POWER & LIGHT CO. and the WASHINGTON WATER POWER CO. have filed reduced rate schedules for apple producers. The reduction is in the form of a renewal of the 40 percent slash on pumping and spray rates, which has been in effect for the last two years, as an aid toward a long-range rehabilitation program of the apple industry. At the end of this year the three years' saving will total more than $500,000, it was estimated.

•

Recent Legislation

IOWA—Legislature has adjourned without passing a bill that asked exemption from taxation for co-operative corporations and associations not operated for profit and engaged in generating or furnishing electric energy to farms, farm establishments, rural churches, schools, villages and towns under six hundred population where electric service is not otherwise available.

OHIO—House taxation committee recently killed a bill to permit local taxation of publicly owned utilities after Mayor Frank Lausche of Cleveland and other municipal officials voiced a vigorous opposition. The measure was deferred indefinitely by a vote of 12 to 6. Mayor Lausche said cities had been given constitutional authority to operate public utilities and they should be allowed to do so as they saw fit. A House bill reducing from 6 to 3 percent the interest which utilities must pay on consumers' cash deposits has been passed by the Senate and is now ready for the Governor's signature.

•

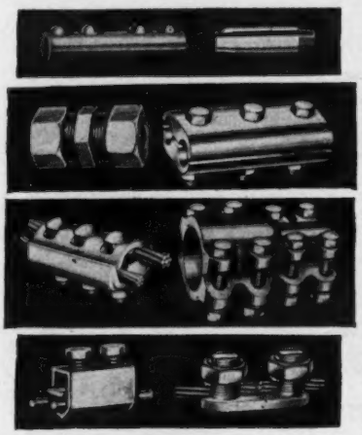
New Television Movie

The wonders of home entertainment made possible through the medium of television are presented in General Electric Co.'s new television movie, "Sightseeing at Home," which was recently released. The movie was made at G.E.'s television studio, WRGB, at Schenectady. The movie is available to schools, churches, service men's clubs at no cost other than transportation charges and may be obtained from G.E. film distribution centers in major cities.

"It sure is HANDY— to have ALL kinds in One Catalog!"

For any good Straight or Parallel Connector, see the* COMPLETE *line

These illustrations can only suggest the wide variety in the Penn-Union Catalog . . . a *complete* line of Bolted Straight Connectors and Reducers . . . Screw type . . . Split Sleeve type . . . Shrink fit . . . Universal Parallel Clamps . . . E-Z Connectors that take a wide range of conductor sizes.



Also . . . the most complete line of Service Connectors, Tee Connectors, Cable Taps . . . Elbow and Cross Connectors . . . Bus Supports, Clamps, Spacers . . . Grounding Clamps, Terminal Lugs.

Penn-Union connectors are the first choice of leading utilities, industrials, electrical manufacturers and contractors—because they have found that *"Penn-Union" on a fitting is their best guarantee of Dependability.*

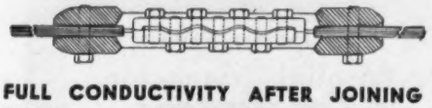
PENN-UNION ELECTRIC CORPORATION
ERIE, PA. *Sold by Leading Jobbers*

PENN-UNION
Conductor Fittings

A fine wire is no better than its connections

STRAIGHT CONNECTOR
for Aluminum Cable

BOLT-PRESSURE TYPE
Capacity: No. 4 to 4/0 — With Solid Core Wire Only



FULL CONDUCTIVITY AFTER JOINING CABLE . . . GRIP EQUAL TO TENSILE STRENGTH OF CABLE

Designed to join cable, comprised of one hard steel wire surrounded by aluminum strands. A joint thus made will withstand a tensile strain equal to the rated tensile strength of the cable itself, without injury to the cable, and without (by test) causing a noticeable millivolt drop.

★ **WRITE FOR BULLETIN 14-A** ★

K&H **KRUEGER & HUDEPOHL**
Solderless Terminal Lugs and Connectors
S. E. VINE AT THIRD • CINCINNATI, OHIO

need EXTRA hands?

one person with APëCO can do the work of many

Making Copies of Anything Written, Printed, Drawn or Photographed

Here is a machine that multiplies Man-Power and saves equipment,—releasing men, women and their equipment for other work. Speeds up your production! Saves valuable hours now spent on copying and tracing by making photo-exact copies at small expense. Get copies right in your own place of business, without delays. APëCO makes copies up to 18"x22". 1 to 100 copies or more. No chance for error! No need for proof-reading! Legally acceptable. Used by leaders throughout industry.

FOOLPROOF OPERATION!

With our simple instructions, any office boy or girl can produce perfect, photo-exact copies of letters, blueprints, priorities, specifications, drawings, etc., at any desk or table. No skill or dark room is needed.

PROMPT DELIVERY

—on machines and supplies. Learn how *others in your field* have benefited. Write for FREE folder *now!* Representatives in all principal cities and Canada.

CUT TIME ON COPIES OF
LETTERS
BLUEPRINTS
DRAWINGS
TRACINGS
WORK ORDERS
PRIORITIES
SPECIFICATIONS
RECORDS
RECEIPTS
LEGAL PAPERS
PHOTOGRAPHS
STATISTICS
BULLETINS
GRAPHS

$55.00 F.O.B. CHICAGO

AMERICAN PHOTOCOPY EQUIPMENT CO.
2849 N. Clark St. Dept. C.F.-1 Chicago, Ill.

Sales Opportunities

WASHINGTON—Bonneville Power Administration, Department of Interior, Portland, Ore., has authorized construction of initial unit of new hydroelectric power development. It will include power dam, generating station designed for an ultimate capacity of about 140,000-kw., switchyard and transmission line to connect with Bonneville high-tension system. Surveys and investigations are being carried out by U. S. District Engineer Office, Pittock Building, Portland.

NEW JERSEY—General Motors Corp., Detroit, Mich., plans expansion in plant for production of aircraft products for government, including installation of machinery and electrical equipment. Cost estimated about $800,000, with financing by Defense Plant Corp.

WISCONSIN—Cudahy Water Works Co., Cudahy, plans expansion in pumping station for increased water supply, including installation of two new electrically operated pumping units and auxiliary electrical equipment. Also construction of power line from neighboring power house at plant of Cudahy Brothers Co., which will be used as power source, to pumping station, about 7,000 ft. long. Application has been made for permission.

KANSAS—Boeing Aircraft Co., Wichita, plans expansion in plant for production for government, including new building and installation of machinery and electrical equipment. Entire project will cost about $1,000,000, with financing by Defense Plant Corp. Work will be carried out at early date. Main offices of company are at Seattle, Wash.

OHIO—Toledo Edison Co., Toledo, plans immediate replacement of damage at power plant, caused recently by fire, with loss reported close to $50,000, including equipment.

NEW JERSEY—Wright Aeronautical Corp., 132 Beckwith St., Paterson, manufacturer of airplane engines and parts, has plans maturing for power plant. Cost reported over $70,000, with financing by government. Albert Kahn Associated Architects & Engineers, Inc., New Center Building, Detroit, Mich., is architect and engineer.

CALIFORNIA—War Department, Washington, D. C., has authorized expansion in air force base, including hangars, shops and other industrial buildings, with installation of machinery and electrical equipment. Also will construct barracks and other buildings, with extensions in electrical distribution system and power substation facilities. Entire project will cost over $5,000,000 and will be supervised by District Engineer Office, Los Angeles. Proposed to begin work soon.

NEW YORK—National Lead Co., 111 Broadway, New York, will construct and operate new plant for production for government, including several buildings, with installation of machinery and electrical equipment for large capacity. Cost about $1,500,000, with financing by Defense Plant Corp. Work is scheduled to begin at early date.

WASHINGTON—Navy Department, Washington, D. C., has authorized expansion in naval air station, including new hangar and

COFFING HOISTS ARE WORKING FOR UNCLE SAM

If your supply house cannot furnish you with Coffing Hoists *when* you want them you may be sure that Uncle Sam's orders are being filled first because we are certain he is placing them where they will do the most good. Coffing Hoists are also helping skilled labor to do the job better and faster on our production front.

COFFING HOIST CO.
Manufacturers of
Ratchet Lever, Spur Geared, Electric and Differential Hoists
Trolleys
Utility Maintenance Tools
DANVILLE, ILLINOIS

Solves the Problem of Mailing List Maintenance!

Probably no other organization is as well equipped as McGraw-Hill to solve the complicated problem of list maintenance during this period of unparalleled change in industrial personnel.

McGraw-Hill Mailing Lists cover most major industries. They are compiled from exclusive sources, and are based on hundreds of thousands of mail questionnaires and the reports of a nation-wide field staff. All names are guaranteed accurate within 2%.

When planning your direct mail advertising and sales promotion, consider this unique and economical service in relation to your product. Details on request.

Mc GRAW-HILL
DIRECT MAIL LIST SERVICE

McGraw-Hill Publishing Co., Inc.
DIRECT MAIL DIVISION
330 West 42nd Street New York, N. Y.

Natvar

FLEXIBLE INSULATION!

VARNISHED CAMBRICS
VARNISHED PAPERS
SATURATED SLEEVING
VARNISHED AND
LACQUERED TUBING
EXTRUDED TUBING
CABLE IDENTIFICATION
MARKERS

In all commercial sizes, in accordance with standard and special specifications.

•

PROMPT SERVICE!
QUICK DELIVERIES!

•

THE NATIONAL VARNISHED PRODUCTS CORP.
211 Randolph Avenue, Woodbridge, New Jersey

G.C.A.
Lamp Replacers
Lamp Base
Removers
Cartridge Fuse
Tongs
Switch Hooks

Send for Catalogue

We have been making safety tools for 27 years

THE G. C. A.
Manufacturing Co.
Pittsfield, Mass.

HIGH GRADE
HARD PORCELAIN
FOR
Electrical Specialties
High and Low Voltages

IMPERIAL
PORCELAIN WORKS
TRENTON, NEW JERSEY

other structures, with installation of electrical equipment. Also other facilities for naval air transport service. Entire project will cost close to $1,000,000. Bureau of Yards and Docks, Navy Department, Washington, D. C., will be in charge.

OHIO—Timken Roller Bearing Co., Canton, plans expansion in plant for production for government, including new building and installation of machinery and electrical equipment. Entire project will cost about $1,750,000, and will be financed by Defense Plant Corp. Work will be carried out soon.

ALABAMA—Water Department, Mobile, plans extensions and improvements in water system, including pumping station with electrically operated pumping machinery, controls and auxiliary equipment, reservoir, pipe lines and other facilities. Entire project is estimated to cost about $800,000. Application has been made for federal loan and grant, and permission to proceed with project.

NEW JERSEY—Eastern Aircraft, Linden Division, General Motors Corp., Linden, plans early construction of new multi-story power plant for service at plant. Cost reported over $200,000, with equipment. Financing by Defense Plant Corp.

ILLINOIS—Ahlberg Bearing Co., 3025 West 47th St., Chicago, manufacturer of ball and roller bearings, will carry out expansion in plant for production for government, including new building and installation of machinery and equipment. Work is scheduled to begin soon. Cost estimated about $1,000,000, with financing by Defense Plant Corp.

NORTH DAKOTA — Civil Aeronautics Authority, Washington, D. C., has begun surveys for new airport, including hangars, shops and other structures, with electrical equipment installation. Also, electrical distribution system, with lighting system, control station and other facilities. Entire project is estimated to cost about $950,000. Airways Engineering Branch, CCA, 608 South Dearborn St., Chicago, Ill., in charge.

•

G.E. Workers' Ideas Save 1,250,000 Man-Hours

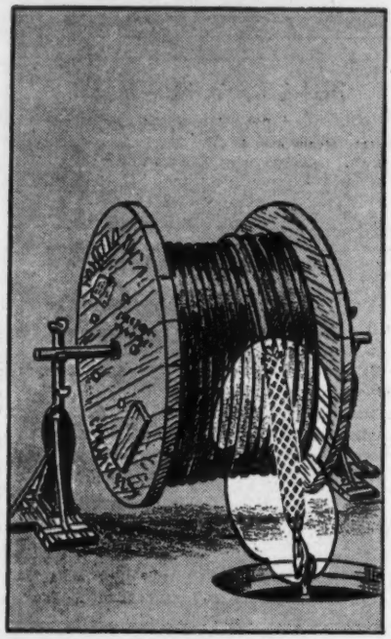
War workers' production ideas saved 1,250,000 man-hours in General Electric plants during 1942, according to a statement by the company, announcing that a record $158,943 was paid last year for 16,204 suggestions adopted of 53,945 submitted.

"Besides the time," the statement pointed out, "the suggestions adopted saved more than a million pounds of steel as well as large quantities of aluminum, copper, stainless steel, tin, chromium and other vital metals."

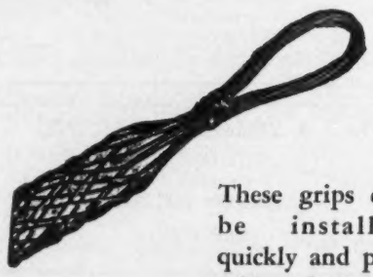
Two workers, Jerry Buccuzzo of Lynn, Mass., and Joseph Mizak of Bridgeport, Conn., received single awards of $1,200 each, equaling an individual mark set in 1926.

Since the suggestion system was started at General Electric, approximately 25 years ago, the company has paid out more than $1,300,000 to employees.

SPEED
CONSTRUCTION
and EXPANSION
of PLANT FACILITIES



RELIABLE CABLE GRIPS
For Pulling in
Wires and Cable



These grips can be installed quickly and pull cables dependably. They do not let go halfway through a duct because the wires pull with evenly distributed load. Eight different styles — all supplied in a full range of sizes.

Reliable
ELECTRIC COMPANY
OVER 30 YEARS SERVICE TO THE UTILITIES

PROFESSIONAL SERVICES

BARKER & WHEELER

Utility and Industrial Valuations, Design and Construction of Power Systems, Water Supplies, Sewerage and Sewage Disposal, Factory Production and Cost Control Systems.

11 Park Place, New York City
36 State Street, Albany, N. Y.

H. F. FERGUSON

Consulting Electrical Engineer

Rate Investigations and Comparisons
Plant Surveys—Reports

288 Alameda Avenue Youngstown, Ohio

J. H. MANNING & COMPANY

ENGINEERING
SERVICES

120 BROADWAY, NEW YORK

BLACK & VEATCH

Consulting Engineers

Water, Steam and Electric Power Investigations, Design, Supervision of Construction, Valuation, Tests and Laboratory Service.

4706 Broadway, Kansas City, Mo.

ROBERT E. FOLEY CONSTRUCTION CORPORATION

Rural Lines—Transmission Lines
Fire Alarms—Telephone Lines

48 Griswold St. Binghamton, N. Y.

DANIEL W. MEAD
F. W. SCHEIDENHELM

Consulting Engineers

Hydro-Electric Development, Dams, Water Supply, Flood Control, Engineering Problems relating to Water Rights and Water Power Law. Appraisals.

New York City, 50 Church St.

E. J. CHENEY AND CO.

ENGINEERS AND CONSULTANTS

Design, Supervision of Construction
Rehabilitation Engineering, Reports, Studies
Valuations, Economic and Business Surveys

61 Broadway New York

FORD, BACON & DAVIS, Inc.

ENGINEERS

DESIGN • CONSTRUCTION
VALUATIONS • REPORTS

New York—Philadelphia—Washington—Chicago

ARTHUR L. MULLERGREN

Engineering-Management
Public Utilities—Natural Gas

Kansas City, Mo.

COLUMBIA ENGINEERING CORP.

STRUCTURAL, MECHANICAL & ELECTRICAL ENGINEERS

War Plant Design - Supervision of Construction - Engineering Reports

61 Broadway New York, N. Y.
323 Plum Street Cincinnati, Ohio

FRANK F. FOWLE & CO.

Electrical and Mechanical
ENGINEERS

35 East Wacker Drive Chicago, Ill.

Recording & Statistical Corp.

BILL ANALYSIS—CONSUMPTION STUDIES
THE ONE-STEP METHOD

Bill Frequency Analyzer

102 Maiden Lane New York

HUGH L. COOPER & CO. INC.

General Hydraulic Engineering, including the design, financing, construction and management of hydro-electric power plants.

30 Rockefeller Plaza New York

GILBERT ASSOCIATES, INC.

Engineers and Consultants

DESIGN, CONSTRUCT, OPERATE & MAINTAIN INDUSTRIALS AND PUBLIC UTILITIES

Reports • Rates • Labor relations • Safety • Purchasing • Costs • Laboratory

61 Broadway New York Reading, Pa. National Press Bldg. Washington, D. C.

SANDERSON & PORTER

Engineers
for the
FINANCING—REORGANIZATION—DESIGN—CONSTRUCTION—
of
INDUSTRIAL and PUBLIC UTILITIES

Chicago New York San Francisco

JULIEN H. DAVIS

Member A.I.E.E.

Consulting Engineer

Industrial
Utility—Electrical—Mechanical

740 So. Broadway Los Angeles, Calif.

HENKELS & McCOY

(Electric & Telephone Line Construction Co.)

Wood pole transmission lines
Electric Distribution and maintenance

Philadelphia, Pa.

SARGENT & LUNDY

ENGINEERS

140 South Dearborn St.

Chicago, Ill.

DAY & ZIMMERMANN, INC.

ENGINEERS

Design - Construction - Management
Investigations and Reports

NEW YORK PHILADELPHIA Packard Building CHICAGO

HOOSIER ENGINEERING COMPANY

Erecting Engineers
Transmission Lines, Substations

46 So. 5th St., Columbus, Ohio
327 South LaSalle Street, Chicago, Ill.
136 Liberty St., New York

STONE & WEBSTER ENGINEERING CORPORATION

Design and Construction
Reports • Examinations • Appraisals
Consulting Engineering

BOSTON • NEW YORK • CHICAGO • HOUSTON
PITTSBURGH • SAN FRANCISCO • LOS ANGELES

Ebasco Services Incorporated

Industrial Division

Design and Construction
Financial and Operating Consultation
Investigations and Reports
Consulting Engineering

Two Rector Street New York

WILLIAM S. LEFFLER

succeeding
CHARLES F. LACOMBE—WILLIAM S. LEFFLER
Engineers—Economists

RATE RESEARCH — SALES RESEARCH
FOR
POST-WAR PLANNING
Cost Analysis Rate Cases

Noroton, Connecticut

WELSBACH ENGINEERING AND MANAGEMENT CORPORATION

Engineering - Electrical Construction - Management - Electric and Gas Street Lighting Maintenance

1500 Walnut Street Philadelphia, Pa.

Electrical Testing Laboratories Inc.

WAR WORK TESTS

ELECTRICAL — MECHANICAL — PHYSICAL — CHEMICAL — for compliance with Government Specifications.

Inspection—Analysis—Research—Certification

2 East End Avenue at 79th Street New York

CHAS. T. MAIN, INC.

Engineers

Boston, Mass.

Electric, Steam and Hydraulic Projects.
Investigations, Reports, Designs and Appraisals.

THE J. G. WHITE ENGINEERING CORPORATION

Engineers — Constructors

New York, N. Y.

EVERSTICK ANCHORS...

FOR SPEED IN INSTALLATION

The exclusive Everstick nut housing locks the Anchor firmly on the rod. This speeds up installation. Plates are so designed, that they expand easily into undisturbed earth, and extra holding power is achieved. Made of tough, rust-resistant malleable iron. Write for bulletin.

EVERSTICK ANCHOR CO.
FAIRFIELD, IOWA

TRICO FUSE PULLERS

PROTECT

MAN POWER

Keep on the job—not on the injury list. Pull fuses the safe way—USE A TRICO FUSE PULLER and avoid severe injuries, shocks, burns, infections, or even death. ORDER SOME TODAY!

TRICO FUSE MFG. CO. Milwaukee, Wisconsin

STAR METER SEAL

Eliminates meter tampering. Cannot be removed without mutilating. SEND FOR SAMPLE.

STAR PORCELAIN CO.
51 Muirhead Ave. Trenton, N. J.

LETTER TO THE EDITOR

Automatic Air-Breaks for Transmission Taps

To the Editor of ELECTRICAL WORLD:

The writer wishes to comment on an article by A. M. McCabe, appearing in the January 9 issue of ELECTRICAL WORLD, entitled "Automatic Air-Breaks in Lieu of Oil-Breakers."

We have had five such breakers on the high-voltage side of our system, where voltage transformation is 66/12 kv. and capacities from 1,000 to 3,000 kw. The system feeding these banks is energized by a diesel plant and a hydro plant (at Coolidge Dam) at the ends of a 70-mile transmission line.

This line passes over a rough, mountainous region and there is much trouble caused by lightning and line surges. Operation of an air-breaker, due to such causes, will usually open both oil circuit-breakers at the stations, making it necessary to synchronize between the plants and pick up the loads. This, in spite of the fact that the manufacturers have given the apparatus considerable attention.

Our experience indicates that such equipment is full of trouble caused by the long period of arcing between the opening blades. Some money may be saved, but service is tremendously sacrificed.

CLARK J. WELLS, Electrical Engineer
U. S. Department of Interior,
San Carlos Project, Coolidge, Ariz.

•

"Nothing to Sell" Era Stimulates Advertising

Recognition of the important part of the trade press in promoting the security of post-war markets, as well as in the winning of the war, is shown in the release of Marmon-Herrington contracts for advertising space in 1943.

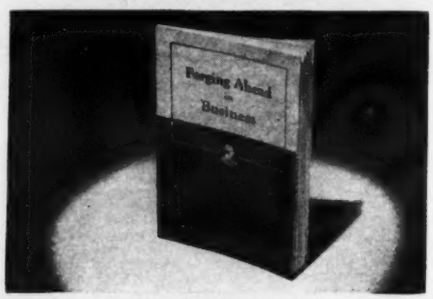
This company is continuing its insertions in a wide list of publications this year, even though there are no Marmon-Herrington vehicles available except for military and most essential civilian services.

Asked to define Marmon-Herrington's policy concerning advertising in a period when the company has practically "nothing to sell," Bert Dingley, president, said that lack of actual sales contacts was all the more reason for advertising contacts, if the manufacturer hoped to return to markets left uncultivated during the war.

ALL the strength and durability inherent in steel are combined—with definite economies—in *Crapo* Galvanized Steel Strand. Heavy, ductile, tightly-bonded zinc coatings, applied by the famous *Crapo* Galvanizing Process, provide lasting protection against corrosion.

Ask the distributor of *Crapo* Galvanized Products near you or write direct for further information!

INDIANA STEEL & WIRE CO.
MUNCIE, INDIANA



Every Ambitious Man in Industry Should Read this Free Booklet!

"FORGING AHEAD IN BUSINESS" contains FACTS for all thoughtful, forward-looking men; it has a message of particular interest to *technical men.*

This 64-page booklet, of which more than 3,000,000 copies have been circulated, outlines a definite plan of training for your future progress in industry.

Said one man who had sent for it:

"In thirty minutes this booklet gave me a clearer picture of my business future than I have ever had before."

Fill in the coupon below and this helpful manual will be sent to you by mail and without cost.

ALEXANDER HAMILTON INSTITUTE,
Dept. 23, 73 West 23rd Street, New York, N. Y.
In Canada, 54 Wellington St., West, Toronto, Ont.
Please mail me a copy of the 64-page book—"FORGING AHEAD IN BUSINESS."

Name.....

Address.....

WANTED

CHIEF ACCOUNTANT

for Municipal Utilities sober studious man with minimum five years utility accounting, draft exempt. Qualify $10,000 bond paid by us. Salary $325 monthly; also vacation, sick leave, pension, life insurance. Permanent. Pacific Northwest. Air mail qualifications and reference covering experience and character. One of the best hunting and fishing areas in the world.

P-538, Electrical World
68 Post Street, San Francisco, Calif.

POSITION VACANT

DIVISION MANAGER—A company which has conformed to the intregration definition and is operating in a prosperous, rapidly growing territory desires an experienced division manager capable of taking complete charge of operating division containing approximately 21,000 electric customers. Knowledge of and experience in all phases of utility operations is essential with special emphasis upon ability to understand people and to operate in a manner sympathetic to the public interest. Prefer a man at least 40 years of age, experienced in utility operations in the South or Southwest. Territory contains good schools and colleges and living conditions are excellent. This is a permanent position with a solid company and should provide a lifetime of work. P-539, Electrical World, 520 N. Michigan Ave., Chicago, Ill

EMPLOYMENT SERVICE

SALARIED POSITIONS — This advertising service of 33 years' recognized standing negotiates for high salaried supervisory, technical and executive positions. Procedure will be individualized to your personal requirements and will not conflict with Manpower Commission. Retaining fee protected by refund provision. Identity covered and present position protected. Send for details. R. W. BIXBY, Inc. 262 Delward Bldg., Buffalo, N. Y.

POSITIONS WANTED

ELECTRICAL CONSTRUCTION ENGINEER—Estimating quantity take off, purchasing, administration. Travel. PW-532, Electrical World, 330 W. 42nd St., New York, N. Y.

MAN—age 38—20 years experience in Power plant, both steam and Hydro. Would like a position as manager or assistant manager of Hydro plant either private or municipal owned. Can give best of reference. PW-540, Electrical World, 330 W. 42nd St., New York, N. Y.

EXECUTIVE—Age 48. 18 years experience electric and gas utility management. Presently employed, but impendent transfer of ownership prompts interest in new connection with permanent future. Highly successful background in public relations, sales, personnel direction and other phases of utility management, plus broad understanding of operations. PW-541, Electrical World, 520 N. Michigan Ave., Chicago, Ill.

ELECTRICAL ENGINEER—Technical education—age 34 — married — wide maintenance experience in industrial chemical plant—present company 10 years—desire position of a permanent nature and opportunity for further advancement — present employer on partial War production orders. Can obtain release. PW-542, Electrical World, 330 W. 42nd St., New York, N. Y.

OPERATING SUPERINTENDENT. Experienced in Operation, Construction, Design, Maintenance and Research. Twenty-five years Public Utility Field. Age 51, married, one child. Desire permanent location. PW-543, Electrical World, 520 N. Michigan Ave., Chicago, Ill

SALES REPRESENTATIVES

Can take on established line for sale to utilities, contractors, industrials, jobbers, etc. or else will act for duration for present representative who may be called for military service. We maintain our own office, display room and storage facilities in New York. Prefer line requiring combined technical and commercial experience.

RA-537, Electrical World
330 W. 42nd St., New York City

POST-WAR COLLABORATION:

British Engineering Company having three factories (light, medium, heavy) desires to collaborate with American Manufacturer/s for post-war production. Presently occupied electrical accessories, heavy air-blast switchgear, welded fabrications, and aircraft. Alternative lines of production to the above, Plastics, Air-conditioning, Small Compressors. Prepared to receive applications for spare time Electrical Engineering correspondent. Apply Box C 3058 c/o. W. H. Smith & Son, Ltd., Manchester 3, England.

SEARCHLIGHT SECTION

(Classified Advertising)

EMPLOYMENT : "OPPORTUNITIES" : EQUIPMENT
BUSINESS : : USED OR RESALE

UNDISPLAYED —RATES— DISPLAYED

10 CENTS A WORD. MINIMUM CHARGE $2.00.
Positions Wanted (full or part time salaried employment only) ½ the above rates payable in advance.
Box Numbers—Care of publication New York, Chicago or San Francisco offices count as 10 words.
Discount of 10% if full payment is made in advance for 4 consecutive insretions.

Individual Spaces with border rules for prominent display of advertisements.

The advertising rate is $7.25 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.

An advertising inch is measured ⅞" vertically on one column, 3 columns—30 inches—to a page.

NEW ADVERTISEMENTS received by Monday will appear in Saturday's issue, subject to limitations of space available.

DIESEL ENGINES FOR SALE

1 Ruston-Hornsby horizontal (310 rpm) 4 cycle, continuous duty, 34/38 BHP cap. with 23/26 KW (29/34 KVA) 3 phase, 120/208 V generator with direct connected exciter and slide base.

1 Ruston-Hornsby horizontal (320 rpm) 4 cycle, continuous duty, 28/31 BHP cap. with 18/21 KW (22/25 KVA) 3 phase, 120/208 V generator with direct connected exciter and slide base.

Above is complete with automatic voltage regulators, complete switchboard, water pump, safety devices, alarm system, automatic oil system, filters, etc. Equipment installed new in 1941; used slightly over one year.

TRANSFORMERS FOR SALE

3 Pennsylvania 25 KVA, 3 phase, 2 to 1 ratio; rebuilt within past month.

No priority Necessary.

ECONOMY GROCERY STORES CORP.
Engineering Department
100 Business Street Hyde Park, Mass.

Power Equipment

Released by Utilities & Industrials

Turbines, Generators, Steam and Oil Engines, Boilers, Motor Generators, Rotaries, Transformers, Motors, Compressors, etc.

Service backed by 38 years' experience

BREW, WOLTMAN & CO.
30 Church St., New York

Rotary Converters—3 Ph. 60 Cy.

K.W.	Make	R.P.M.	D.C. Volts	A.C. Volts
1—1500	Whse.	720	650	11500
1—1250	G.E.	720	250	2300
1—1000	Whse.	900	600	2300
2— 750	Whse.	1200	600	2300/4000
1— 200	G.E.	1200	600	13200

Rotary Converters—3 Ph. 25 Cy.

2—1500	G.E.	500	225/275	6600
1— 500	G.E.	750	225/275	6600

M.G. Sets—3 Ph. 60 Cy.

1—1500	G.E.	720	600	6600
1— 500	G.E.	720	600	13200

BELYEA COMPANY, INC.

51 Howell Street, Jersey City, N. J.

ENGINEERS WANTED

A Power Company located in Western Canada has vacancies for three graduate electrical engineers for permanent positions, two as designers in power house and substation design, and one experienced in design of distribution and transmission systems.

Do not apply unless your services are available under Canadian Regulation P.C. 246, Part 3, January, 1943, administered by the Wartime Bureau of Technical Personnel.

Applicants must not be over forty years of age, and should send full particulars of qualifications, experience, references, etc., to

P-536, Electrical World
68 Post Street, San Francisco, Calif.

WANTED

—TRANSFORMERS—

TRANSFORMERS WANTED

in operating condition or burnt out. Mail us list giving complete nameplate data and stating condition.

We Rewind, Repair and Redesign all Makes and Sizes
ALL TRANSFORMERS GUARANTEED FOR ONE YEAR
Prices quoted on request.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
STATION M Since 1912 CINCINNATI, OHIO

WANTED

HYDRAULIC TURBO-GENERATOR

Preferably 110 foot head, 5000 K.W., 3 phase, 60 cycle, with switchboard, etc. Will consider offers of any part or anything over 2500 K.W.

W-535, Electrical World
330 West 42 St., New York City

"Opportunity" Advertising:
Think
"SEARCHLIGHT"
First

POWER FOR PRODUCTION!

MOTORS GENERATOR SETS

—5000 ampere, 6 volt, Hanson-Van Winkle
—2000 ampere, 6 volt, Hanson-Van Winkle
—1500 ampere, 6 volt, Hanson-Van Winkle
—200 KW, 600 volt, GE, sq. cg.
—250 KW, 250 v., GE Synch.
—300 KW, 125 v., Wsgh., Sq. Cage.
—100 KW, 125 v., GE Sq. Cage.
—100 KW, 125 volt, Electric Products, syn.

MOTORS—3 PHASE 60 CYCLE

—500 HP, 1200 RPM, 440 volt, GE, syn.
—400 HP, 514 RPM, 440 volt, Westg, slip ring.
—335 HP, 600 RPM, 2300 volt, GE, syn.
—300 HP, 720 RPM, 2200 volt, G.E., Sl. Rg.
—250 HP, 514 RPM, 4000 volt, G.E., syn.
—250 HP, 600 RPM, 4000 volt, G.E., Sync.
—200 HP, 900 RPM, 440 volt, Westg., sl. rg.
—200 HP, 600 RPM, 2200 volt, G.E., sl. rg.
—200 HP, 450 RPM, 2200/4000 v., G.E., sl. rg.
—150 HP, 1800 RPM, 2300 volt, Al. Ch. sq. cg.
—150 HP, 900 RPM, 440 volt, Al. Ch. sl. rg.
—150 HP, 720 RPM, 440 volt, G.E., slip ring.
—150 HP, 600 RPM, 440 volt, G.E., slip ring.
—150 HP, 400 RPM, 440 volt, G.E., sq. cg.
—125 HP, 720 RPM, 440 volt, G.E., slip ring.
—100 HP, 900 RPM, 440, Westinghouse, sq. cg.
—100 HP, 900 RPM, 440 volt, G.E., slip ring.
—100 HP, 720 RPM, 440 volt, G.E., slip ring.
—100 HP, 720 RPM, 440 volt, G.E., sq. cg.
—100 HP, 600 RPM, 440 volt, G.E., slip ring.
—100 HP, 600 RPM, 440 volt, G.E., sq. cg.
—100 HP, 514 RPM, 440 volt, G.E., sq. cg.
—100 HP, 450 RPM, 440 volt, G.E., sq. cg.
—90 HP, 400 RPM, 550 volt, Cr. Whir, sq. cg.
—75 HP, 900 RPM, 4000 volt, Elec. Mach. syn.
—75 HP, 900 RPM, 220 volt, Fairbanks, Morse, slip ring.
—75 HP, 900 RPM, 440 volt, GE, sq. cg.
—75 HP, 720 RPM, 440 volt, Westghse, slip ring.
—75 HP, 720 RPM, 440 volt, GE, sq. cg.
—50 HP, 900 RPM, 440 volt, GE, slip ring.
—50 HP, 900 RPM, 440 volt, GE, sg. cg.

MOTORS—D.C. 230 VOLTS

—250 HP, 760 RPM, Electro Dynamic.
—150 HP, 750 RPM, Electro Dynamic.
—125 HP, 600 RPM, Westinghouse, SK.
—100 HP, G.E., 575 RPM.
—100 HP, 625 RPM, G.E.
—65 HP, 1000 RPM, G.E., type RC.
—50 HP, 750 RPM, Westinghouse, type SK.
—50 HP, 700 RPM, Crocker Wheeler.
—40 HP, 775 RPM, Westinghouse.
—40 HP, 800 RPM, G.E.
—30 HP, 750 RPM, G.E., type RC.

TRANSFORMERS

—400 KVA, G.E., 4156-240/480 v., Scott taps.
—300 KVA, Pittsburgh, 7800/440 volts.
—250 KVA, Westinghouse, 5500/440 volts.
—200 KVA, Pittsburgh, 7800-110/220 volts.
—200 KVA, General Electric, 2200-220/440 volts
—150 KVA, G.E., 23,000 2300/4000 Y.
—100 KVA, Westinghouse, 11,430/250 volts.
—100 KVA, Pittsburgh, 1375/2750-110/220 volts.
—100 KVA, Westinghouse, 13200 250 volts.
—100 KVA, General Electric, 2300-220/110 volts
—75 KVA, G.E., 13,500-7500/440 volts.
—75 KVA, G.E., 3 phase, 4156Y-120/208Y.
—75 KVA, Pittsburgh, 7600-110/220 volts.
—50 KVA, Wagner, 4150-220 volts.
—50 KVA, Pbgh. 7500/15,000 volts-110/220 volts.
—37½ KVA, 2200-220/110 v.
—25 KVA, Westg., air cooled, 440/220-110 v.
—25 KVA, G.E., 220/110-220/110 volts.
—15 KVA, G.E., 2300-115/230 volts.

MOTORS—VARIABLE SPEED 230 VOLTS

—100 HP, 475/1375 RPM, Electro Dynamic.
—90 HP, 470/940 RPM, General Electric.
—75 HP, 525/1575 RPM, Electro Dynamic.
—60 HP, 600/1200 RPM, General Electric.
—35 HP, 500/1500 RPM, Westinghouse.
—35 HP, 250/1050 RPM, Electro Dynamic.
—30 HP, 225/900 RPM, Crocker Wheeler.
—25 HP, 300/900 RPM, Electro Dynamic.
—20 HP, 750/1500 RPM, General Electric.
—15 HP, 300/1200 RPM, G.E.
—13/18 HP, 250/1200 RPM, Electro Dynamic.
—5 HP, 600/1200 RPM, General Electric.
—5 HP, 450/1800 RPM, Crocker Wheeler.
—5 HP, 400/1600 RPM, Diehl.
—5 HP, 225/900 RPM, Electro Dynamic.

INSTRUMENTS

25—Westinghouse type U recording ammeters with split core CT.
25—Westinghouse type U recording voltmeters.

TURBO-GENERATORS

600 KW Terry dual bleeder condensing Turbine only.
—500 KW, G.E., 3 ph., 60 cy., 480 volt, bleeder.
—375 KVA, Westinghouse, non-condensing.
—300 KW, G.E., 3 ph., 60 cy., 220 volt, cond.
—200 KW, G.E., 3 ph., 60 cy., 220 volt, cond.

OIL CIRCUIT BREAKERS

—3000 amp., 15,000 v., 3 pole, G.E., type FK-136.
—3000 amp., 600 v., 4 pole, G.E., type FK-24.
—1600 amp., 7500 v., 4 pole, Westg., B-2.
—1200 amp., 15000 v., 4 pole, Westg., B-2.
Also complete stock of small sizes.

J. L. HEMPHILL & CO. PHONES
1602 53rd STREET, NORTH BERGEN, N. J.
NEW YORK: LOngacre 5-3227
NEW JERSEY: UNion 3-2600

TURBO-GENERATOR SETS

—500 KW Allis-Chalmers .8 p.f. 3 phase, 60 cycle, 240 volts, 1504 amps. 3600 RPM generator with
—Allis - Chalmers - Parsons turbine, for 150# steam pressure, 100-deg. superheat, 20# absolute back pressure, with
—Exciter, on same shaft as turbine and generator;
—300 KW .8 p.f. Allis Chalmers, a.c. generator, 240 volts, 3 phase, 60 cycle, 3600 RPM, 900 amps. with
—300 KW Allis-Chalmers-Parsons turbine, for 150# steam pressure, 100-deg. superheat, 20% absolute back pressure, with
—Westinghouse switchboard equipment, consisting of
—Generator panels, 2" black slate, 24" wide, 90" high, equipped with
—type 52 style 2B hand-operated rear mounted oil switch,
—Round pattern ac ammeters,
—Integrating wattmeter, AC.,
—D.C. field ammeter,
—Field switch,
—Plug receptacles for synchroscope and volt-meter,
—Field rheostat handle with chain and sprocket control for basement-mounted rheostat,
—Exciter panel,
—Synchroscope,
—Westinghouse voltage regulator, type AB3 on slate panel

Can be seen in operation. Inspection invited.

CHICAGO ELECTRIC CO. 1314 W. CERMAK RD. CHICAGO, ILL.

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies.

POWER PLANT EQUIPMENT
CONSTRUCTION EQUIPMENT
SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

APPARATUS EXCHANGE
EBASCO SERVICES INCORPORATED
Two Rector St. New York, N. Y.

LARGE G. E. INDUCTION MOTORS

—2500 H.P. General Electric Induction Motors — Type MT-28-2500-257 FORM AE, 3 phase, 60 Cycle, 6600 Volts, 257 R.P.M. inc. with starting equipment.
—1500 H.P. General Electric, Induction Motor — Type M.T.-28-2500-257 FORM AE, 3 Phase, 60 Cycle, 6600 Volts, inc. with starting equipment.
—25 K.V.A. Transformers, Distribution G.E. Type H. Single phase 60 cycle 5940/6600/11430Y to 230 Volts
—15 K.V.A. Transformers, Distribution, G.E. Type H. Single phase, 60 cycle, 5940/6600/11430Y, to 115 Volts
—Cable Reels 11' dia. 10' long.

USED A SHORT PERIOD ONLY

WIRE—WRITE—PHONE

SAMUEL HUBERMAN
223-225 No. 4th St. TEL. EVERGREEN 7-3277 Brooklyn, N. Y.

CLOSEOUT

800 New Black & Decker 1/20—1/25 H.P. Fan Duty Motors.
FACTORY PACKED
H. U. MANN
540 Lake Shore Dr. CHICAGO

ADVERTISING IN THIS ISSUE

Air Preheater Corp. 93
*Allis-Chalmers Mfg. Co. 11
American Cyanamid Co., Plastics Division 95
American Photocopy Equipment Co. 120
*American Steel & Wire Co. 30
American Tel. & Tel. Co. 28
*Artkraft Sign Company 119

Barker & Wheeler 122
*Bendix Aviation Corp., Bendix Marine Division 90
Black & Veatch 122
Brewer-Titchener Corp., The 97
*Bright Light Reflector Co., Inc. 92
*Bull Dog Electric Products Co. 104
*Burndy Engineering Co. 18

Cheney & Co., E. J. 122
Coffing Hoist Co. 120
Columbia Engrg. Co. 122
Cooper & Co., Hugh L. 122
Corning Glass Works, Ins. Div. ..16, 17
Crescent Insulated Wire & Cable Co. 24

Dampney Co. of America 83
Davis, Julien H. 122
Day & Zimmermann, Inc. 122
De Laval Separator Co. 111
Delta-Star Electric Co. 29
Directory of Engineers 122
Dugas Engineering Corp. 110

Ebasco Services Inc. 122
Electric Controller & Mfg. Co. 8
*Electrical Engineers Equipment Co. 20
Electrical Testing Laboratories Inc. 122
Electroline Company 5
Elliott Company 6
Engineers, Directory of 122
Everstick Anchor Co. 123

READERS SAY

Readers tell us they read the advertising pages as much as the editorial. And for good reason! A good advertisement, like a good editorial article, brings you useful, worthwhile information in the form you want it. That's why it pays to look through the ads in Electrical World carefully.

*Fairbanks, Morse & Co. 27
Ferguson, H. F. 122
Foley Construction Corp., Robert E. 122
Ford, Bacon & Davis, Inc. 122
*Formica Insulation Co. 113
*Four Wheel Drive Auto Co. 25
Fowle & Co., Frank F. 122

*G. C. A. Mfg. Co. 121
G & W Electric Specialty Co. 23
*General Electric Co. ..65, 67, 68, 69, 71
General Electric Co., Air Conditioning and Commercial Refrigeration Dept. 10
Gilbert Associates, Inc. 122
Gould Storage Battery Corp. 12
Grinnell Co. 26

Hamilton Institute, Alexander 123
Handy & Harman 96
*Hazard Insulated Wire Works 4
Hendy Iron Works, Joshua 91
Henkels & McCoy 122
Hoosier Engineering Co. 122
*Hoskins Manufacturing Co. 87
Hotpoint 14
Hubbard & Co. 103

*Imperial Porcelain Works 121
Indiana Steel & Wire Co. 123
*I-T-E Circuit Breaker Co. ..Third Cover

Kelvinator Division of Nash-Kelvinator Corp. 99
Kerite Insulated Wire & Cable Co., Inc. 34
*Krueger & Hudepohl 120

*Lapp Insulator Co. 33
Leffler, William S. 122

Main, Inc., Chas. T. 122
Manning & Co., J. H. 122
Marmon-Herrington Co., Inc. 77
Matthews Corp., W. N. 115
McGraw-Hill Book Co. 114
Mead, Daniel W. 122
Miller Company, The 22
*Mitchell-Rand Insulation Co., Inc. . 101
*Monitor Controller Co., The 79
Mullergren, Arthur L. 122

*National Varnished Products Corp., The 121

Ohio Brass Co. 9
*Okonite Co. 4
*Okonite-Callender Cable Co. 4
Osmose Wood Preserving Co. of America, Inc. 88

*Pacific Electric Mfg. Co. 3
Paragon Electric Co. 1
*Penn-Union Electric Corp. 1
Philco Corp., Storage Battery Div. 3

*Railway & Industrial Engineering Co. 1
Recording & Statistical Corp. 1
*Reliable Electric Co. 1
Revere Copper and Brass Inc. 7
*Rockbestos Products Corp. 8

Sanderson & Porter 1
*Sangamo Electric Co. 9
Sargent & Lundy 1
Scheidenhelm, F. W. 1
Searchlight Section 124, 1
*Seyler Mfg. Co. 8
Sheldon Service Corp. 1
Simplex Wire & Cable Co. 8
Socony-Vacuum Oil Co., Inc. 1
Standard Oil Co. (Indiana) Back Cover
*Star Porcelain Co., The 1
Stone & Webster Engrg. Corp. 1

Trico Fuse Mfg. Co. 123

*United States Steel Corp. 30, 1
Universal Atlas Cement Co. 1
*Uptegraff Mfg. Co., R. E. 1

Welsbach Engrg. & Mgt. Corp. 1
*Westinghouse Elec. & Mfg. Co. 13, 19, 31, 105, 1
*Weston Electrical Instrument Corp. Second Cover
*Wheeler Reflector Co. 9
White Engrg. Corp., J. G. 1

■

PROFESSIONAL SERVICES 122

■

SEARCHLIGHT SECTION

(Classified Advertising)

BUSINESS OPPORTUNITIES 1
EMPLOYMENT SERVICE 1
POSITIONS VACANT 1
POSITIONS WANTED 1
WANTED TO PURCHASE 1
USED AND SURPLUS EQUIPMENT 124-1
Belyea Co., Inc. 1
Brew, Woltman & Co. 1
Chicago Electric Co. 1
Economy Grocery Stores Corp. 1
Ebasco Services, Inc. 1
Electric Service Co., The 1
Hemphill & Co., J. L. 1
Huberman, Sam 1
Mann, H. U. 1

★ **These companies have supplied additional buying information on their products in the 1943 edition of the Electrical Buyers' Reference**

VE MATERIALS AND MACHINES

On d-c motor drives...

FAULT CURRENTS CAN BE KEPT LOW

This ultra-high-speed circuit breaker is so fast that fault currents can't rise to dangerous values.

ON PRESENT DAY d-c systems with generators, converters or rectifiers connected in parallel, fault currents rise so rapidly that serious damage may be done before a conventional circuit breaker can limit the current. Ordinarily the circuit breaker will open in 3 cycles, in special cases in 1½ cycles, but with fault currents rising at a rate of several million amperes per second, such opening times permit flash-overs to burn brushes and brush-holders. Damage is done; production is stopped for repairs or replacements.

ULTRA-FAST OPENING IS THE ANSWER

The way to protect a system against the effects of rapidly rising currents is to hold the peaks to safe values. I T-E does this with fast-opening circuit breakers. The Type FB circuit breaker, illustrated, has opening characteristics which limit currents within 2/5ths of a cycle (60 cycle basis).

IMPORTANT SAVING OF MATERIALS

When high fault currents are to be encountered, bus structures must be built with heavy conductors and heavy bracing. On the other hand, when peak currents are kept low by ultra-fast circuit breakers, much metal is saved; buses are much simpler.

HIGH-SPEED CIRCUIT BREAKERS HAVE PROVED THEIR VALUE

I-T-E has high-speed circuit breakers in service. They are new but their record is well-founded. Our engineers will gladly tell you about them.

I-T-E

AIR SWITCHGEAR

IMMERSED IN AIR • ENCASED IN STEEL

I-T-E

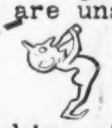
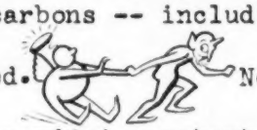
Representatives in Principal Cities

CIRCUIT BREAKER CO., PHILADELPHIA, PA.

EXIT the asphaltene-forming hydrocarbon

(a message to turbine oil users)

Let a hydrogen atom meet a carbon atom down in the earth, and they unite. They have a "yen" for each other.

In petroleum, they are united in countless combinations to form highly complex hydrocarbons. Some of these are unstable. They have an affinity for oxygen. They "drink it in."  Then they're oxidized and ready to go on a rampage. In turbine oil, that means deposits, acidity, sludge, poor demulsibility -- trouble! Some of these little devils tend to form asphaltene substances, others to form acids. The asphaltene kind can all be removed by refining -- but generally are not. Those left act like poor apples in a barrel. Conventional methods fail to get all of them out unless a high degree of refining is used. Without the use of inhibitors, such refining is undesirable because stable hydrocarbons -- including valuable natural inhibitors -- are also removed.  Nonpareil Turbine Oil is a highly refined oil to which has been added a patented inhibitor. When you use Nonpareil, you never will have any troubles from deposits, sludge, or poor demulsibility due to asphaltenes. Acid-forming hydrocarbons are another story. They can't all be removed by refining. How we render them harmless

will be told in our advertisement next month. Meanwhile, if you want further information, send for a Standard Lubrication Engineer. Write or phone the nearest Standard Oil Company (Indiana) office, or 910 South Michigan Ave., Chicago, Ill. In Nebraska, write to Standard Oil Company of Nebraska at Omaha.

NONPAREIL TURBINE OIL

Oil Is Ammunition . . . Use It Wisely

STANDARD OIL COMPANY (INDIANA) STANDARD SERVICE

★ LUBRICATION ENGINEERING